waterloopkundig laboratorium
delft hydraulics laboratory

technische hogeschool delft
afdeling der civiele techniek

eenvoudige turbulentiemodellen voor horizontale gelaagde stromingen

figuren en komputerprogramma

afstudeerverslag

S 656

augustus 1985

technische hogeschool delft
afdeling der civiele techniek

eenvoudige turbulentiemodellen voor horizontale gelaagde stromingen

figuren en komputerprogramma

K. Joppe

afstudeerverslag

S 656

augustus 1985

Waterloopkundig Laboratorium Delft

Afdeling Estuaria en Zeeen

Technische Hogeschool Delft

Afdeling der Civiele Techniek

Vakgroep Waterbouwkunde

Eenvoudige Turbulentiemodellen voor Horizontale Gelaagde Stromingen

Figuren en Komputerprogramma

Afstudeerverslag K. Joppe

Afstudeerdocenten Prof. dr. ir. C.B. Vreugdenhil

Prof. dr. ir. J.P.Th. Kalkwijk

Begeleiders Dr. ir. C. Kranenburg

Ir. G.J.H. Lindijer

S 656

Augustus 1985

Figuren 1 t/m 67

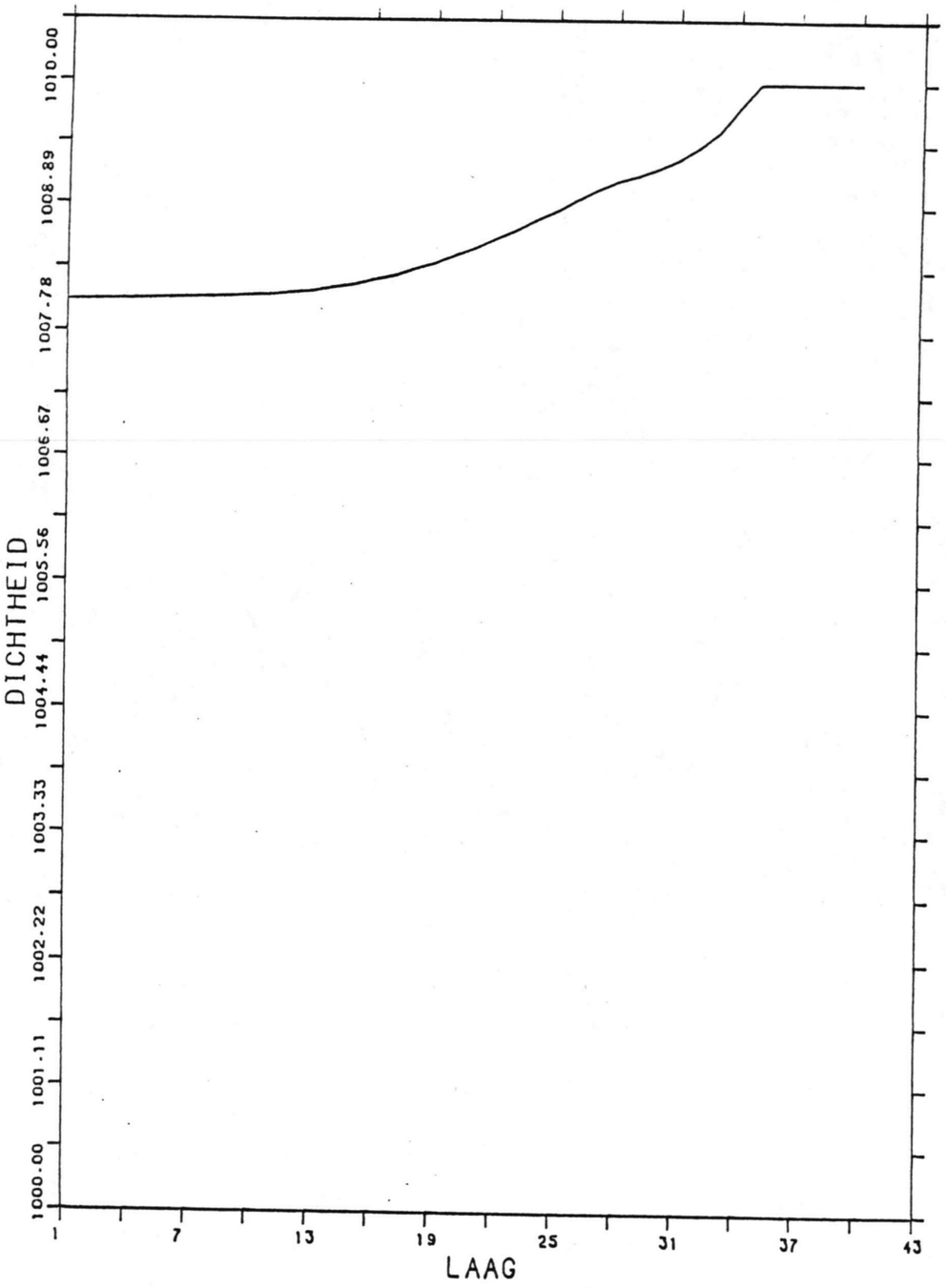

FIG 1

ZWAKKE INSTABILITEIT

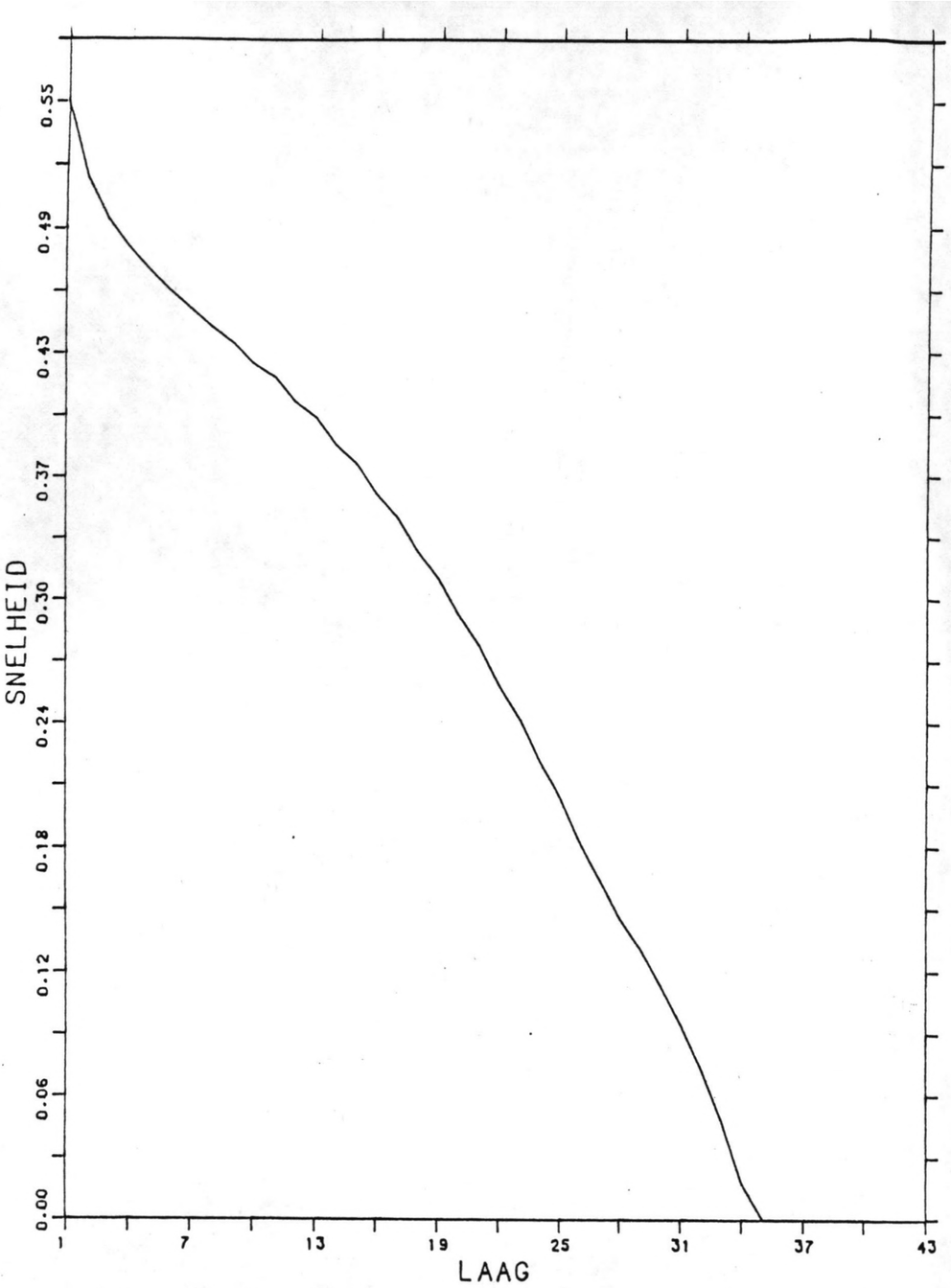

FIG 2

ZWAKKE INSTABILITEIT

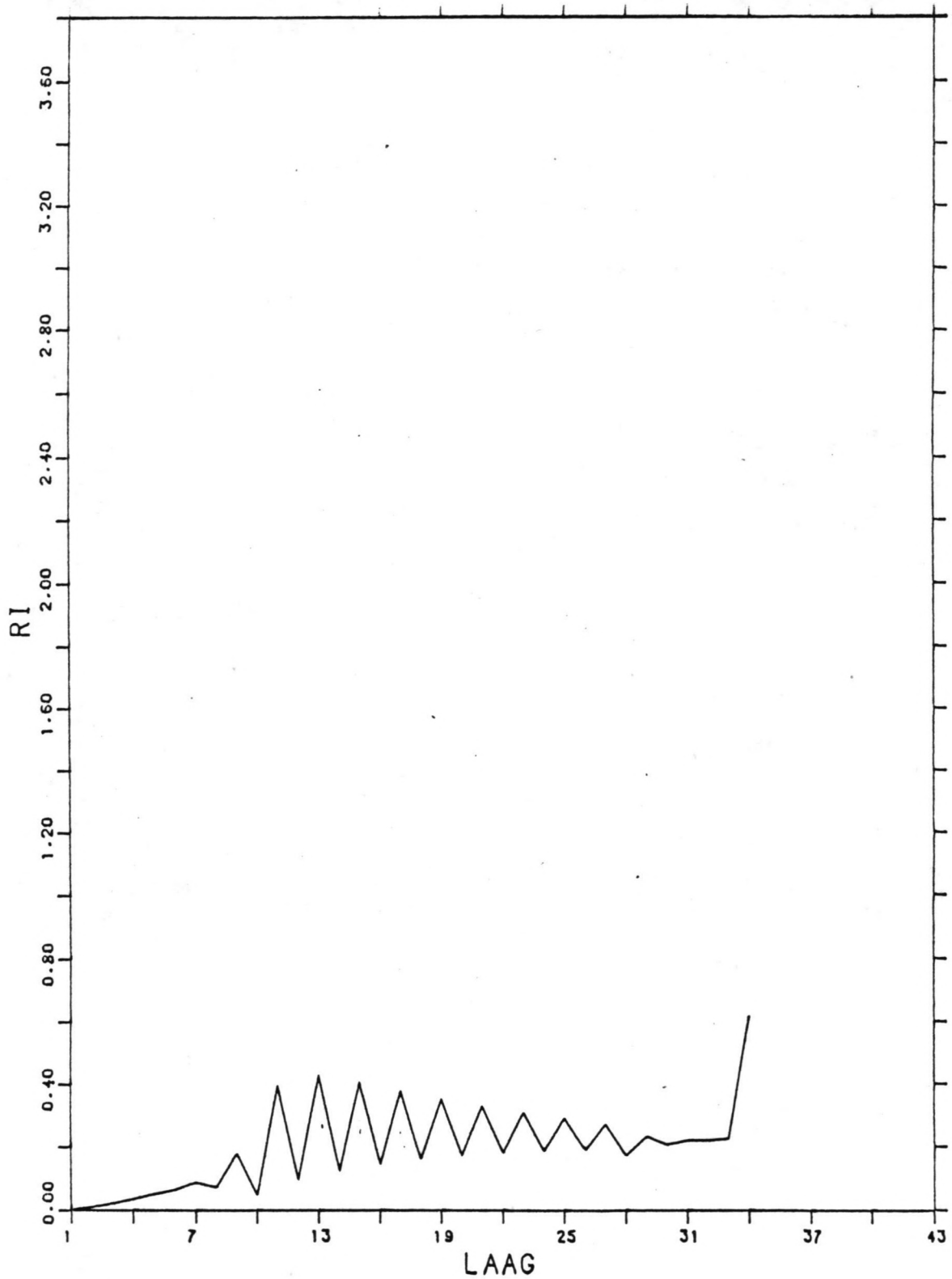

FIG 3

ZWAKKE INSTABILITEIT

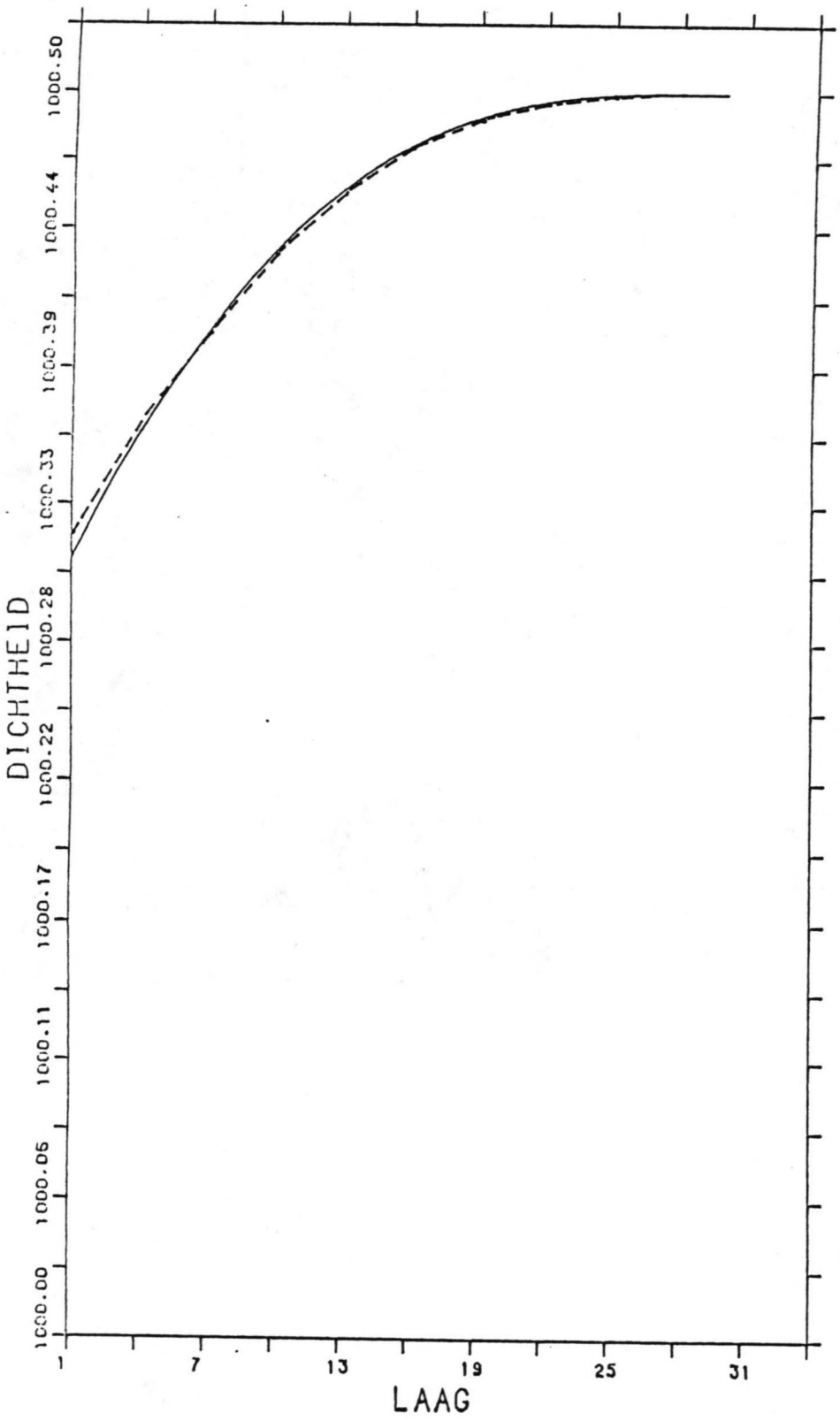

FIG 4

ZWAK GELAAGDE TOESTAND

——— NUMERIEKE OPLOSSING

- - - - ANALYTISCHE OPLOSSING

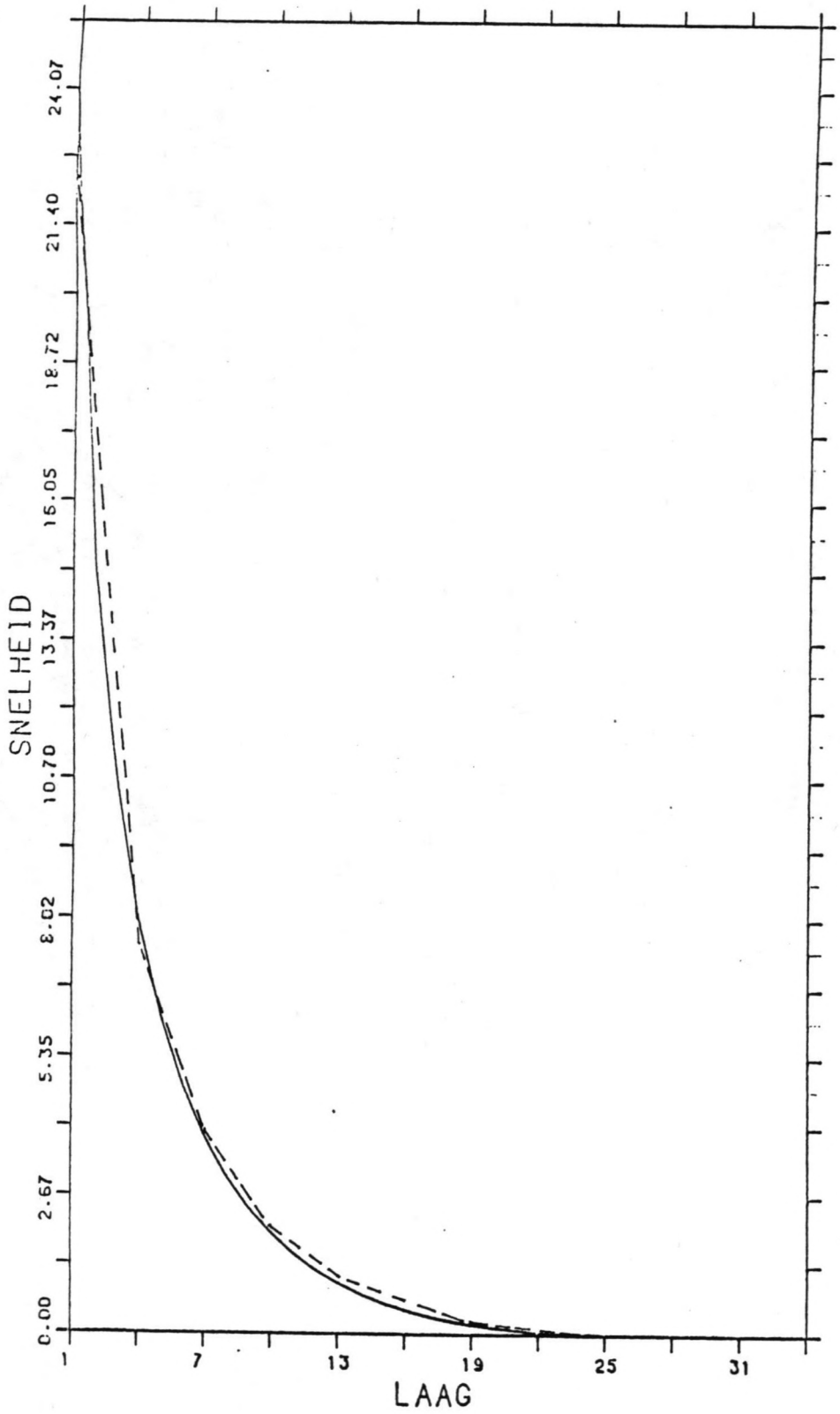

FIG 5
ZWAK GELAAGDE TOESTAND
——— NUMERIEKE OPLOSSING
– – – ANALYTISCHE OPLOSSING

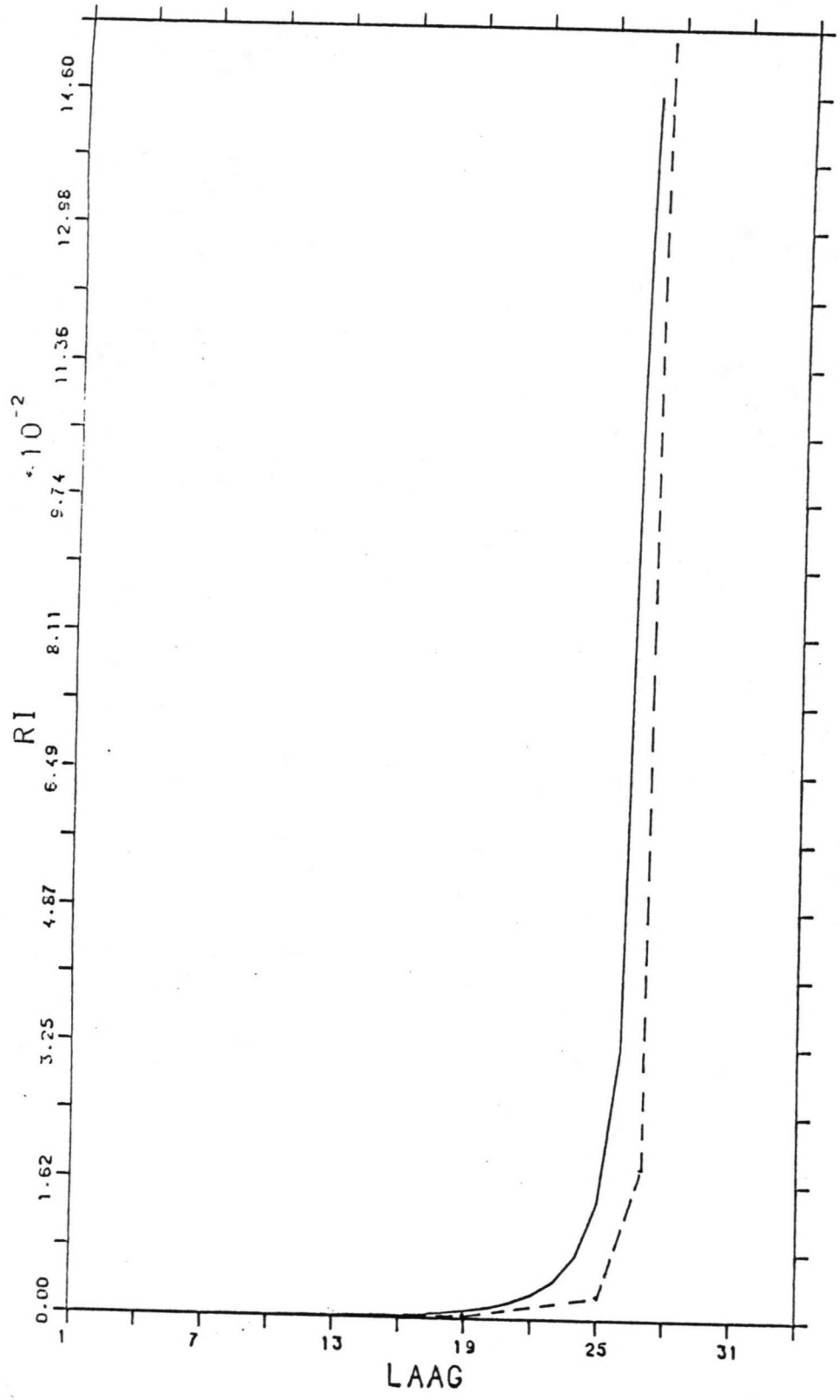

FIG 6

ZWAK GELAAGDE TOESTAND

——— NUMERIEKE OPLOSSING

- - - - ANALYTISCHE OPLOSSING

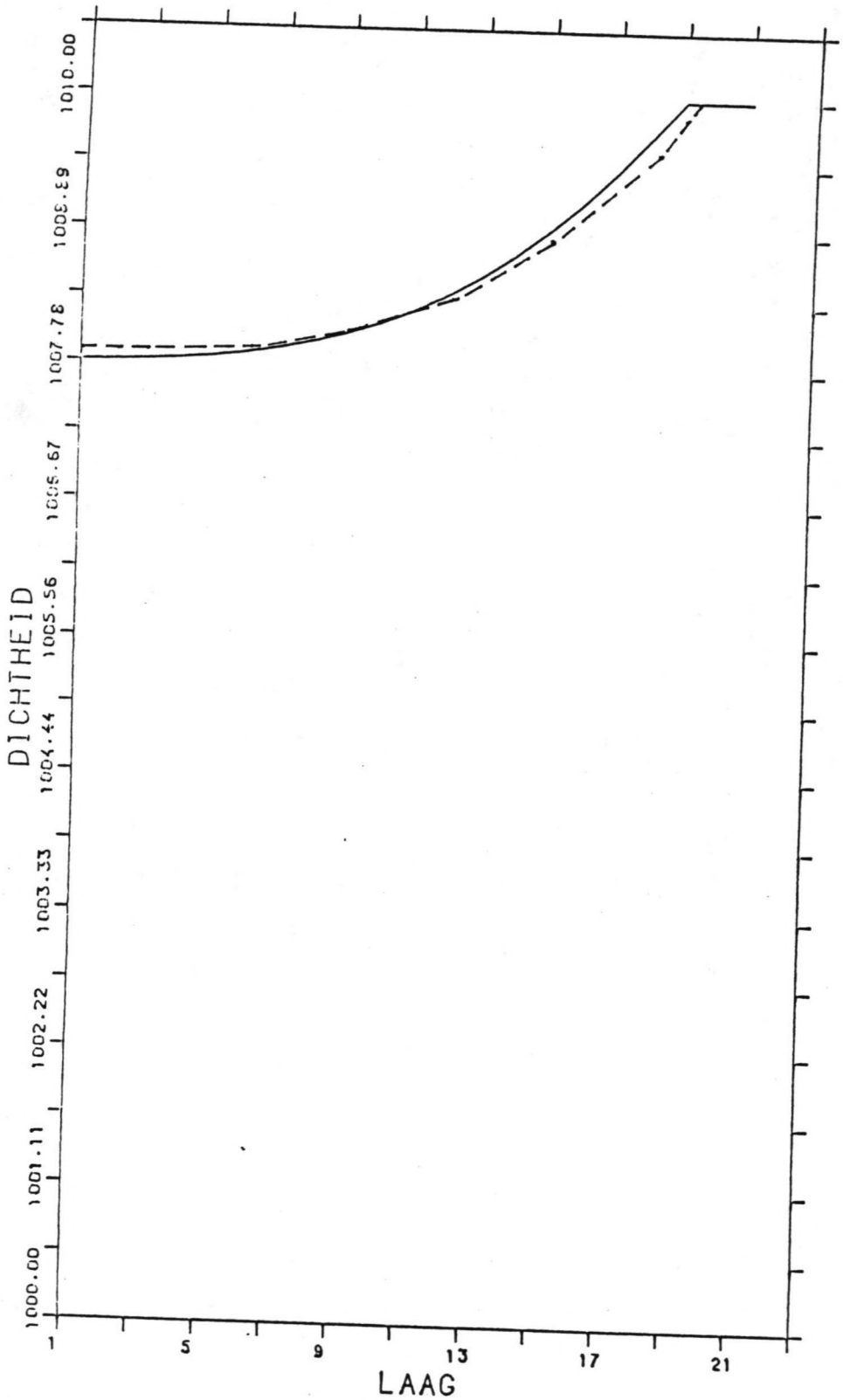

FIG 7

STERK GELAAGDE TOESTAND $\sigma_t = 1{,}0$

——— NUMERIEK

– – – – ANALYTISCH

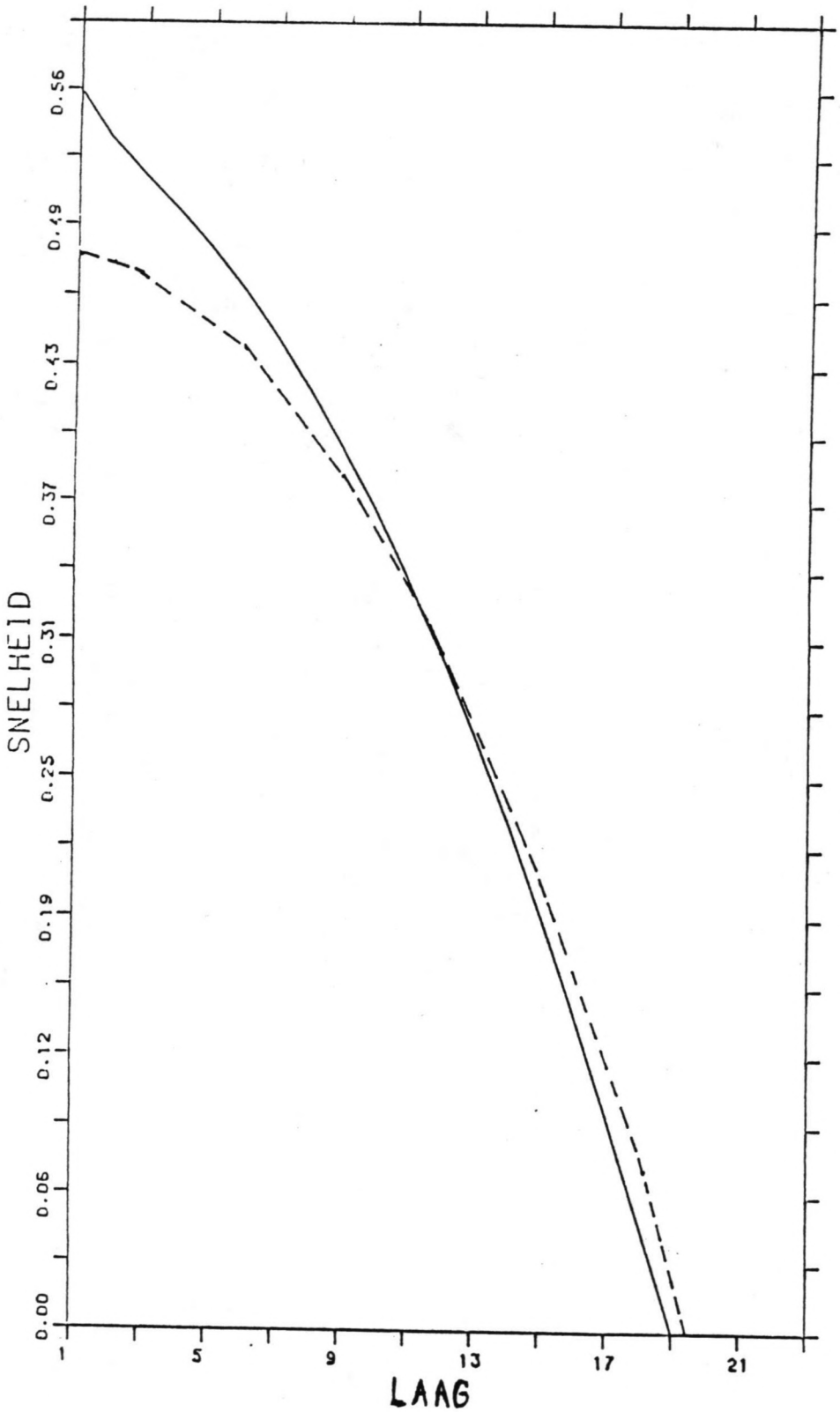

FIG 8

STERK GELAAGDE TOESTAND $q = 1.0$

——— NUMERIEK

– – – ANALYTISCH

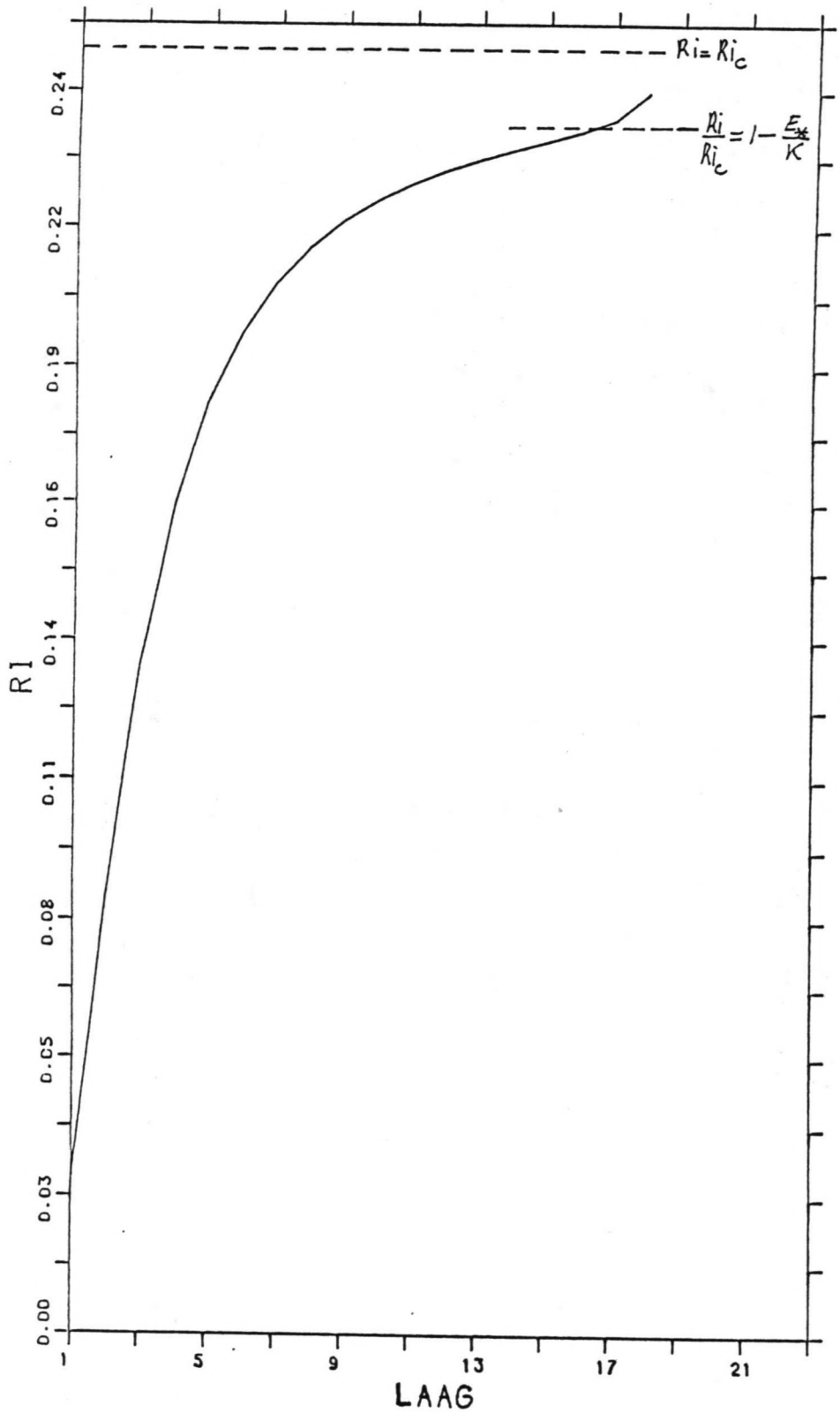

FIG 9

STERK GELAAGDE TOESTAND $\sigma_t = 1{,}0$

——— NUMERIEK

– – – ANALYTISCH

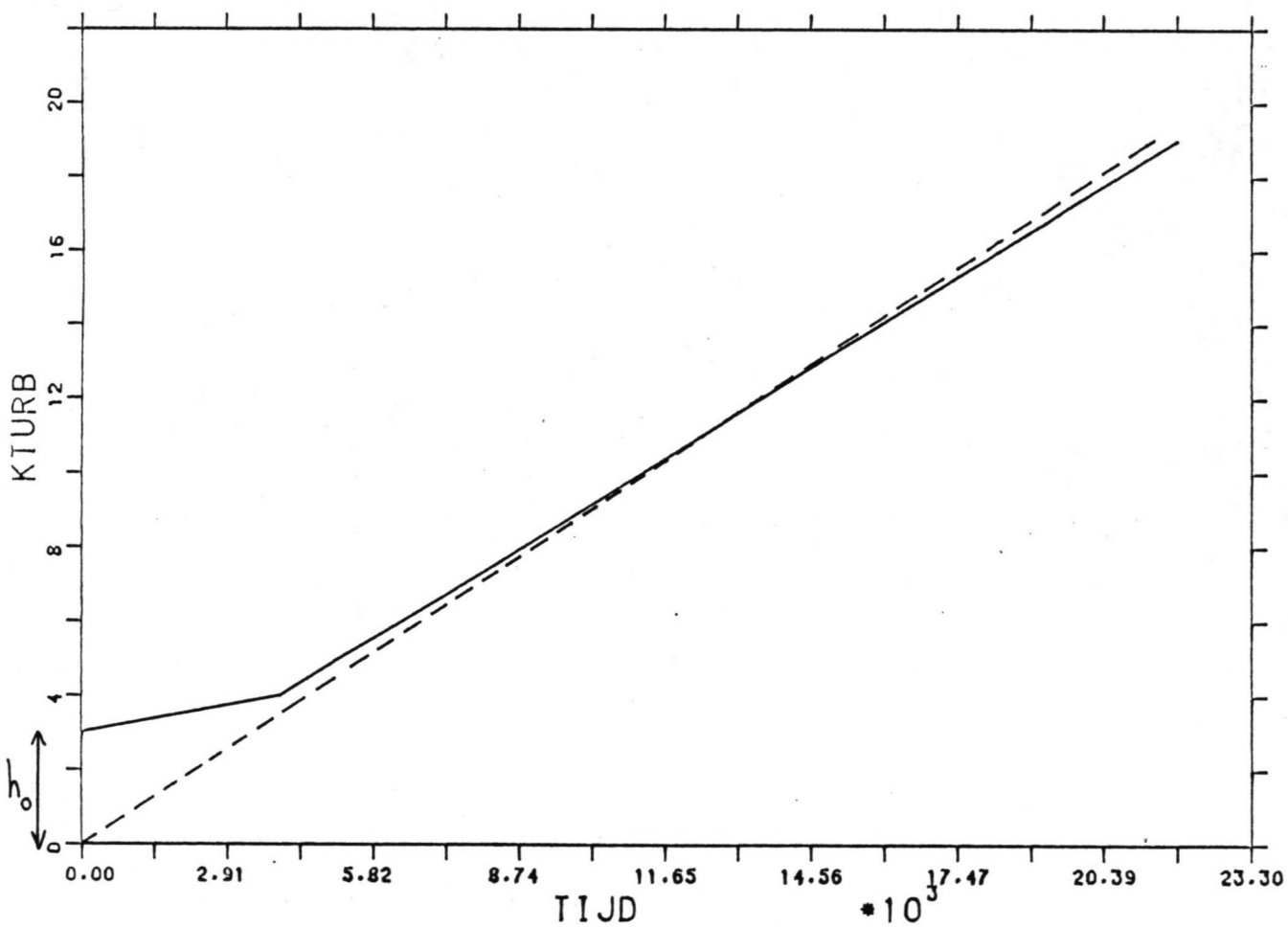

FIG 10

STERK GELAAGDE TOESTAND $\sigma_t = 1{,}0$

——— NUMERIEK

– – – – ANALYTISH

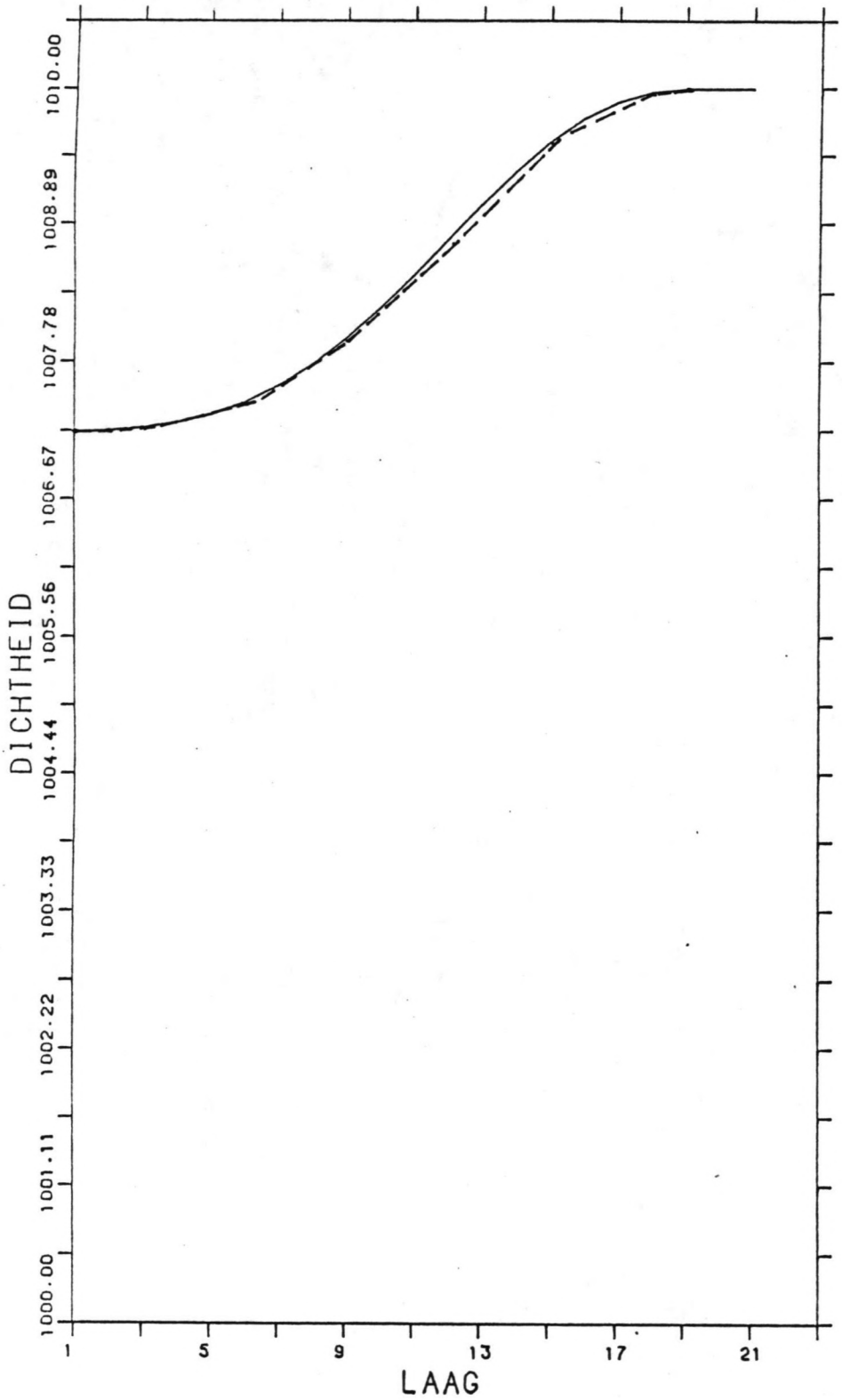

FIG 11

STERK GELAAGDE TOESTAND $\sigma_t = 1{,}5$

——— NUMERIEK

– – – ANALYTISCH

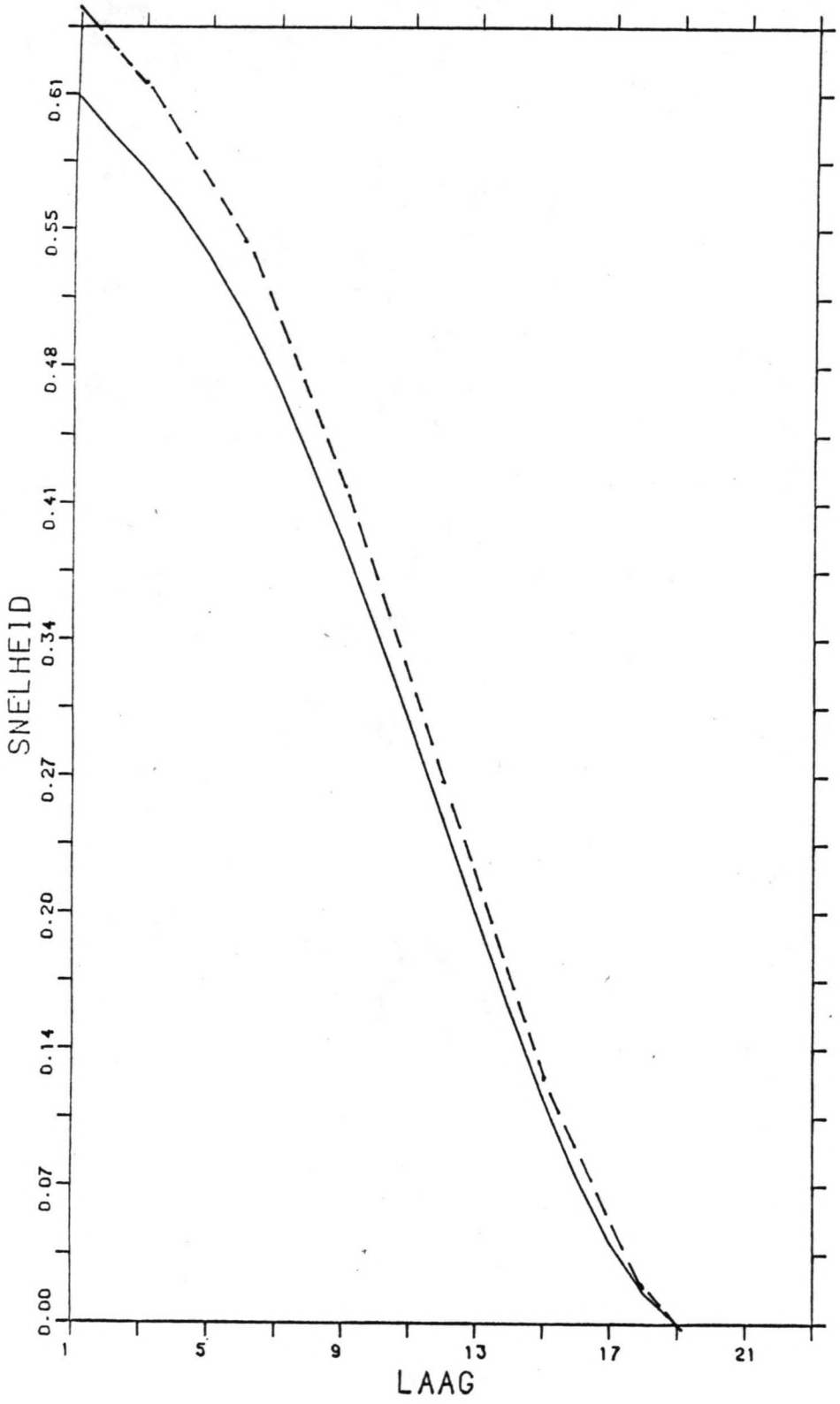

FIG 12

STERK GELAAGDE TOESTAND $\sigma_t = 1{,}5$

——— NUMERIEK

– – – ANALYTISCH

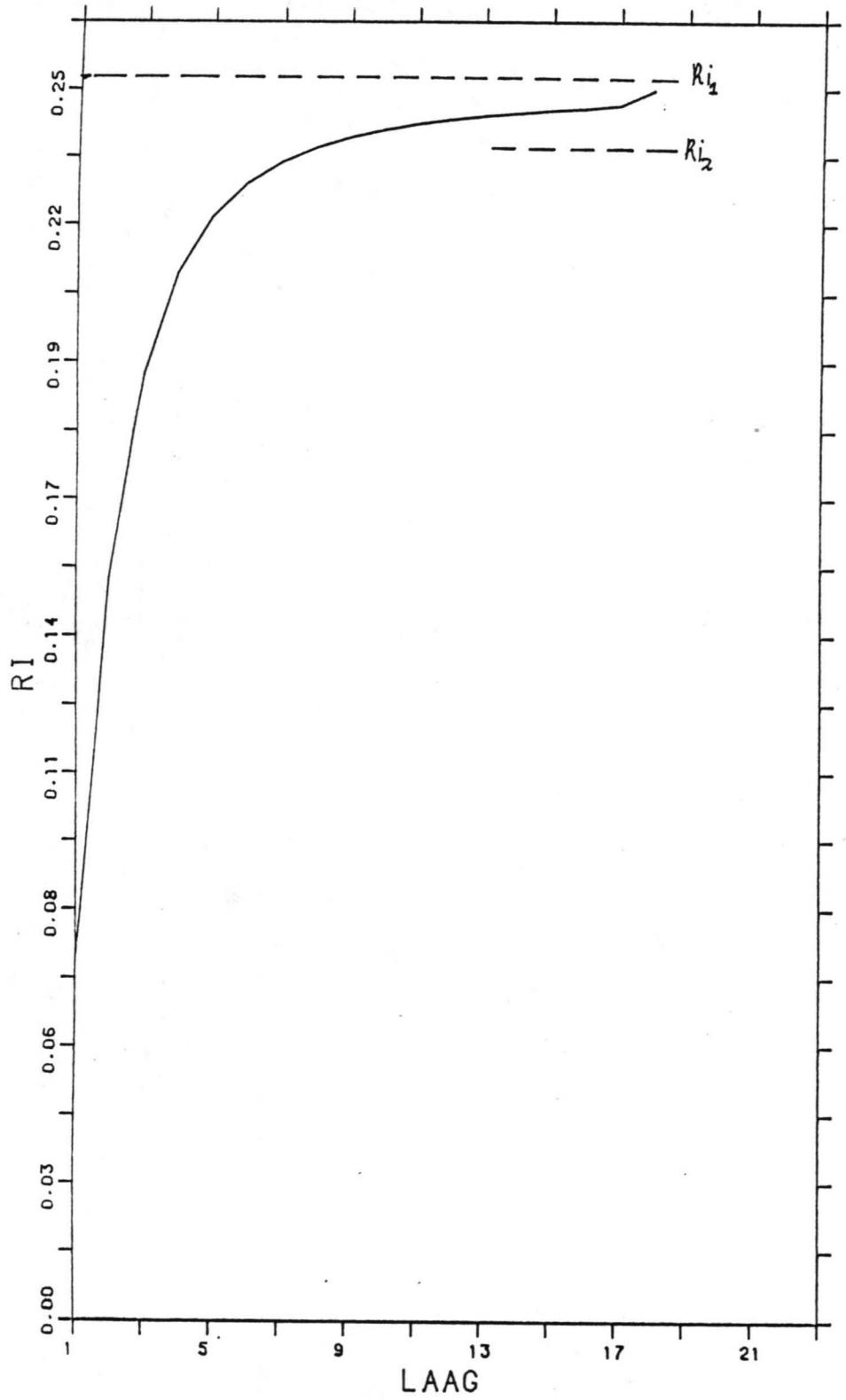

FIG 13
STERK GELAAGDE TOESTAND $\sigma_t = 1{,}5$
——— NUMERIEK
– – – ANALYTISCH

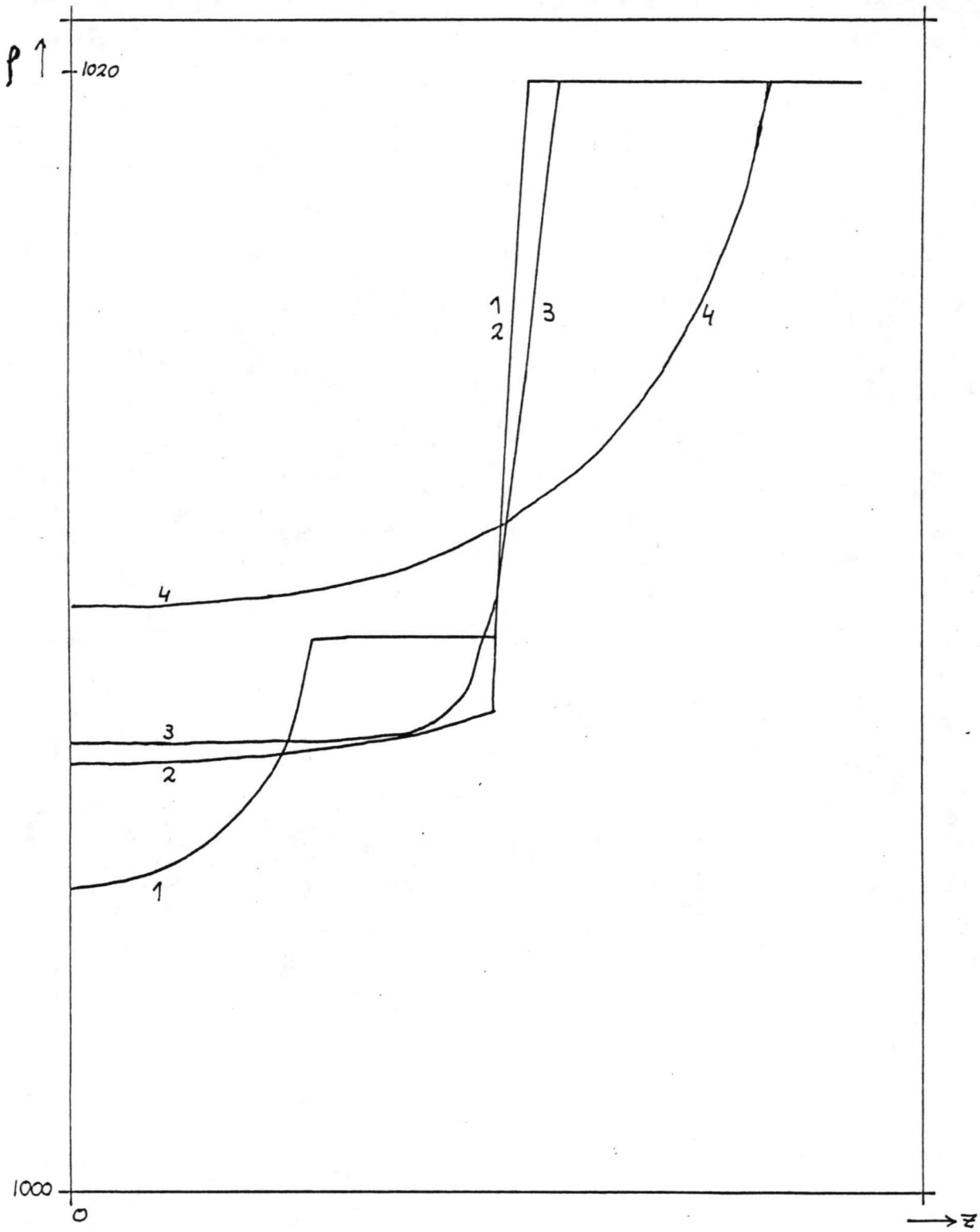

FIG 14
DRIELAGENSYSTEEM

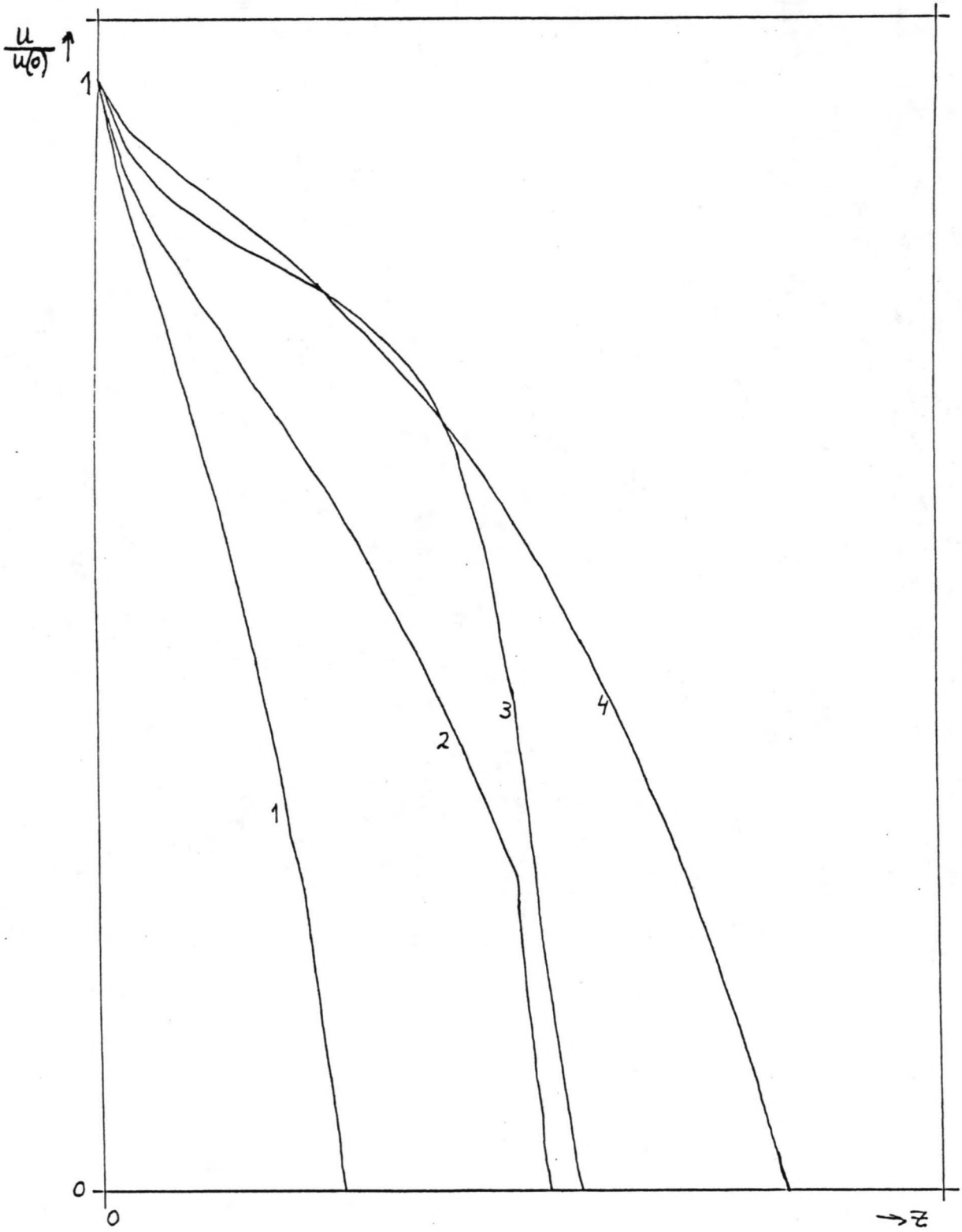

FIG 15
DRIELAGENSYSTEEM

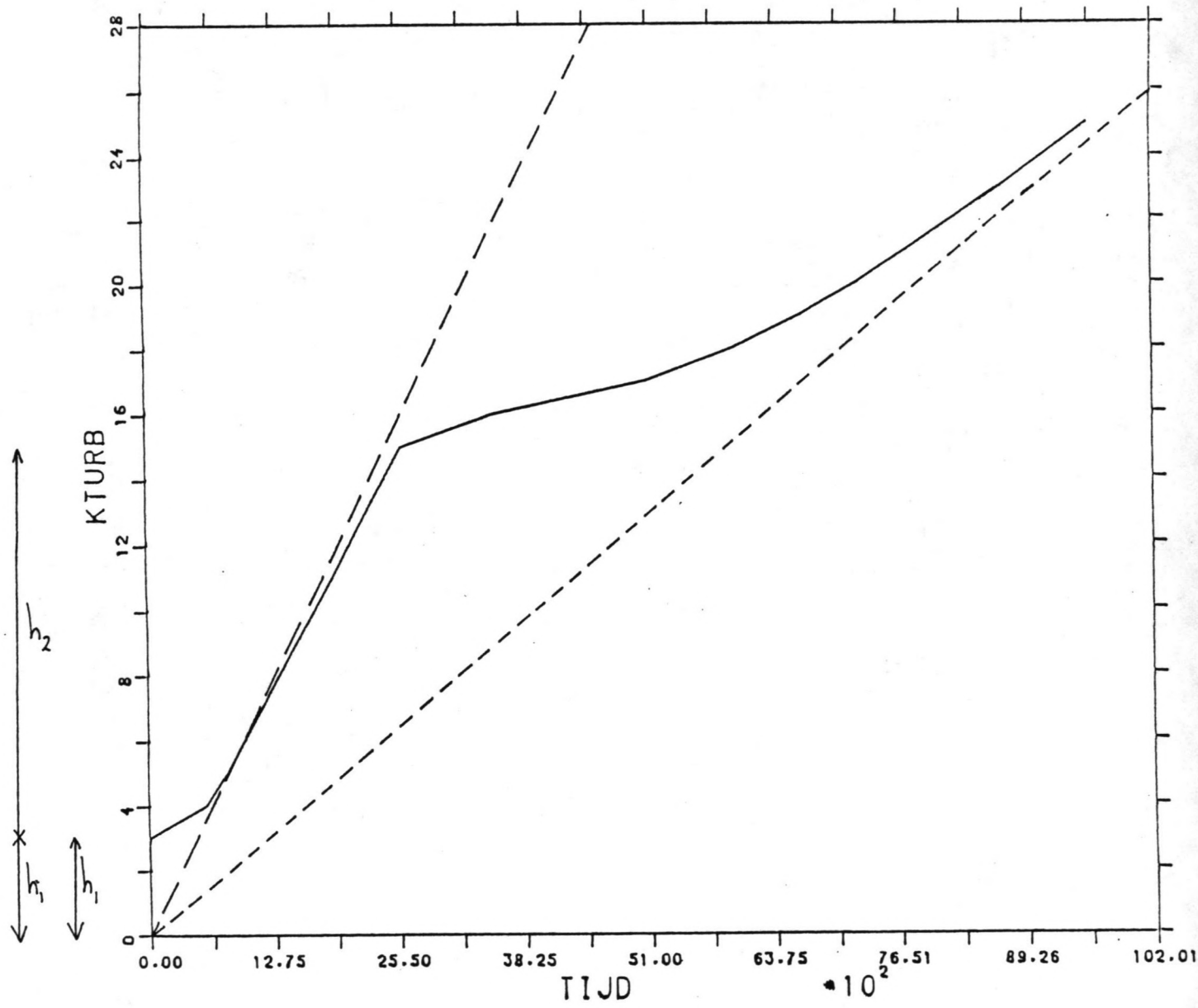

FIG 16
DRIELAGENSYSTEEM

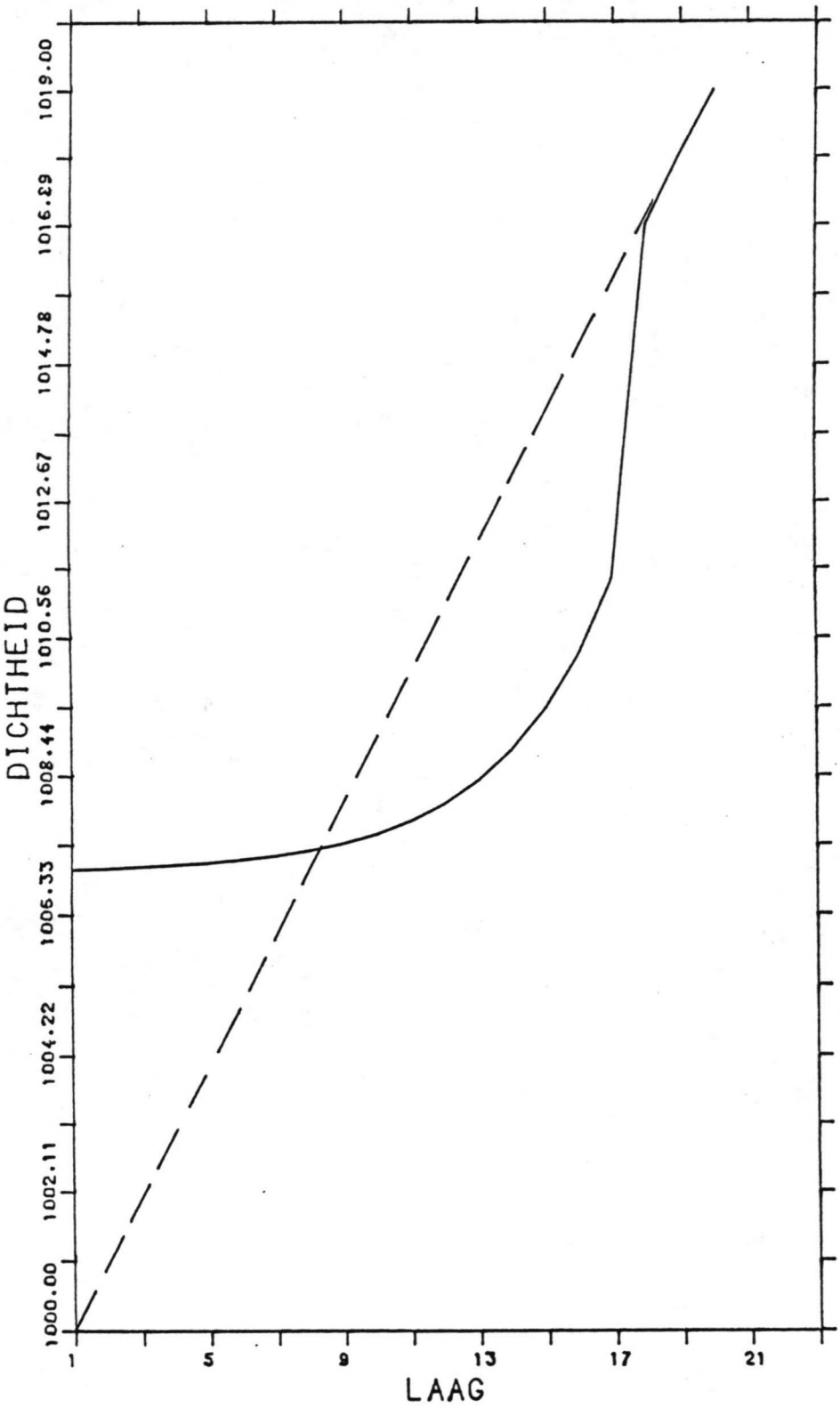

FIG 17

OORSPRONKELIJK LINEAIR DICHTHEIDSPROFIEL

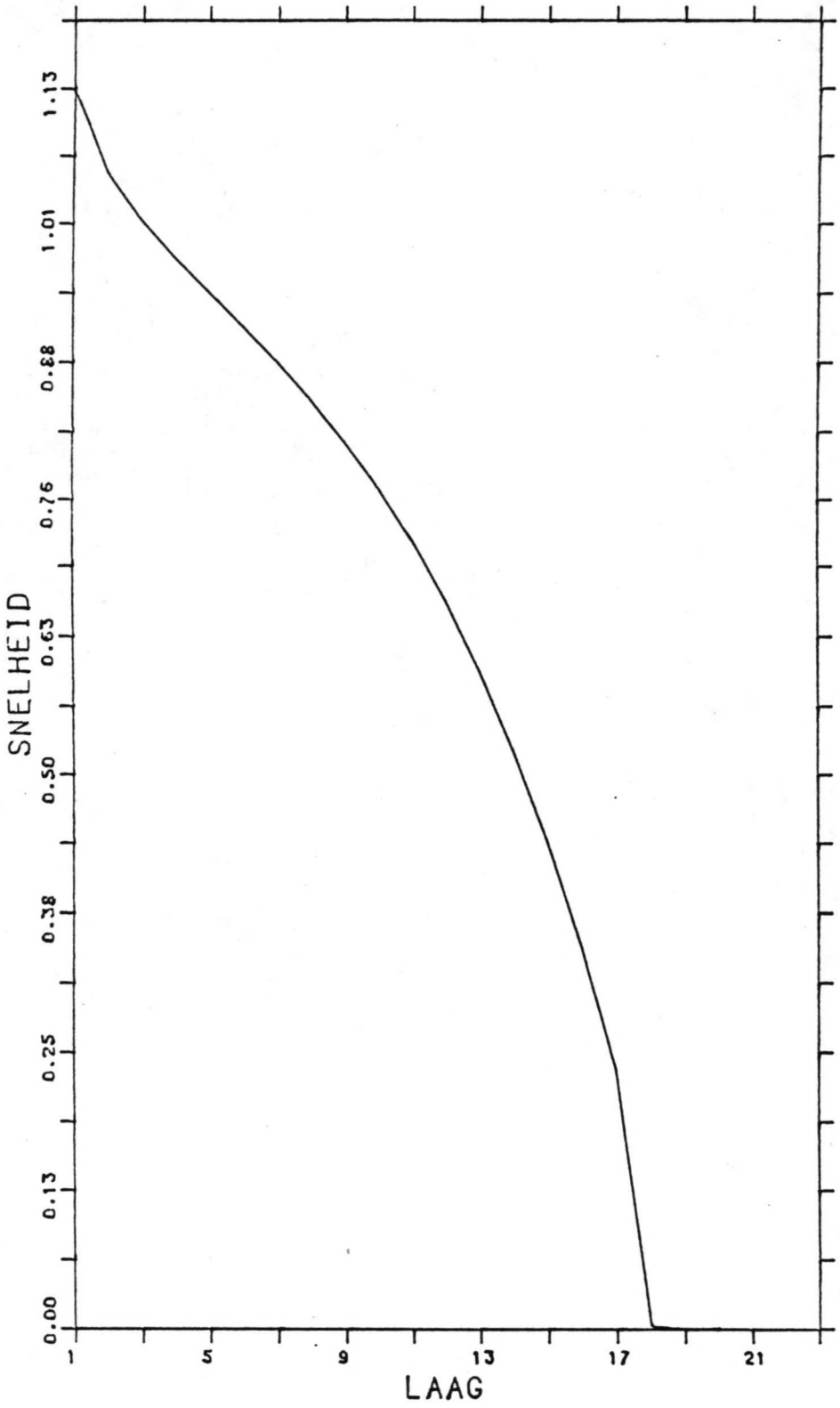

FIG 18

OORSPRONKELIJK LINEAIR DICHTHEIDSPROFIEL

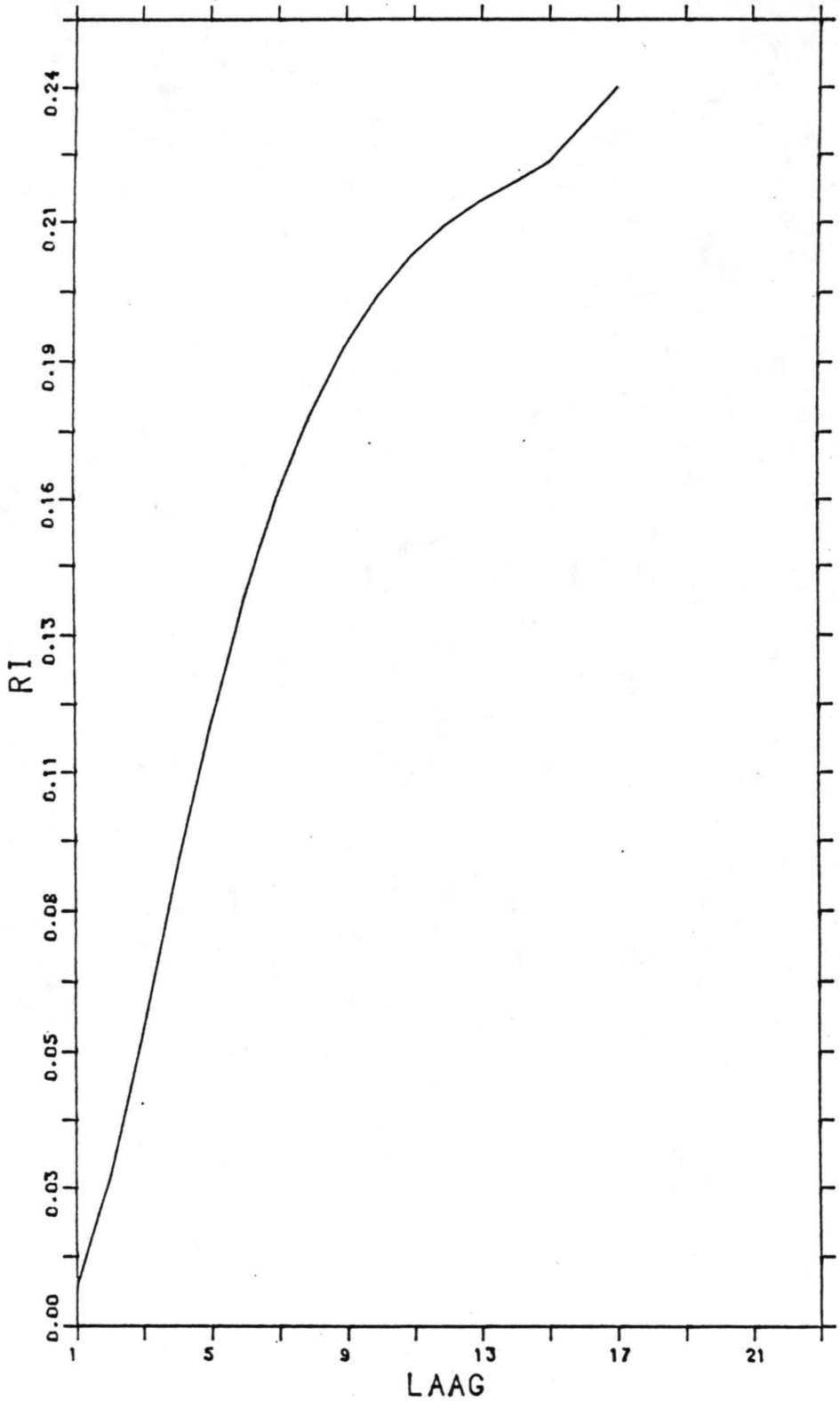

FIG 19

OORSPRONKELIJK LINEAIR DICHTHEIDSPROFIEL

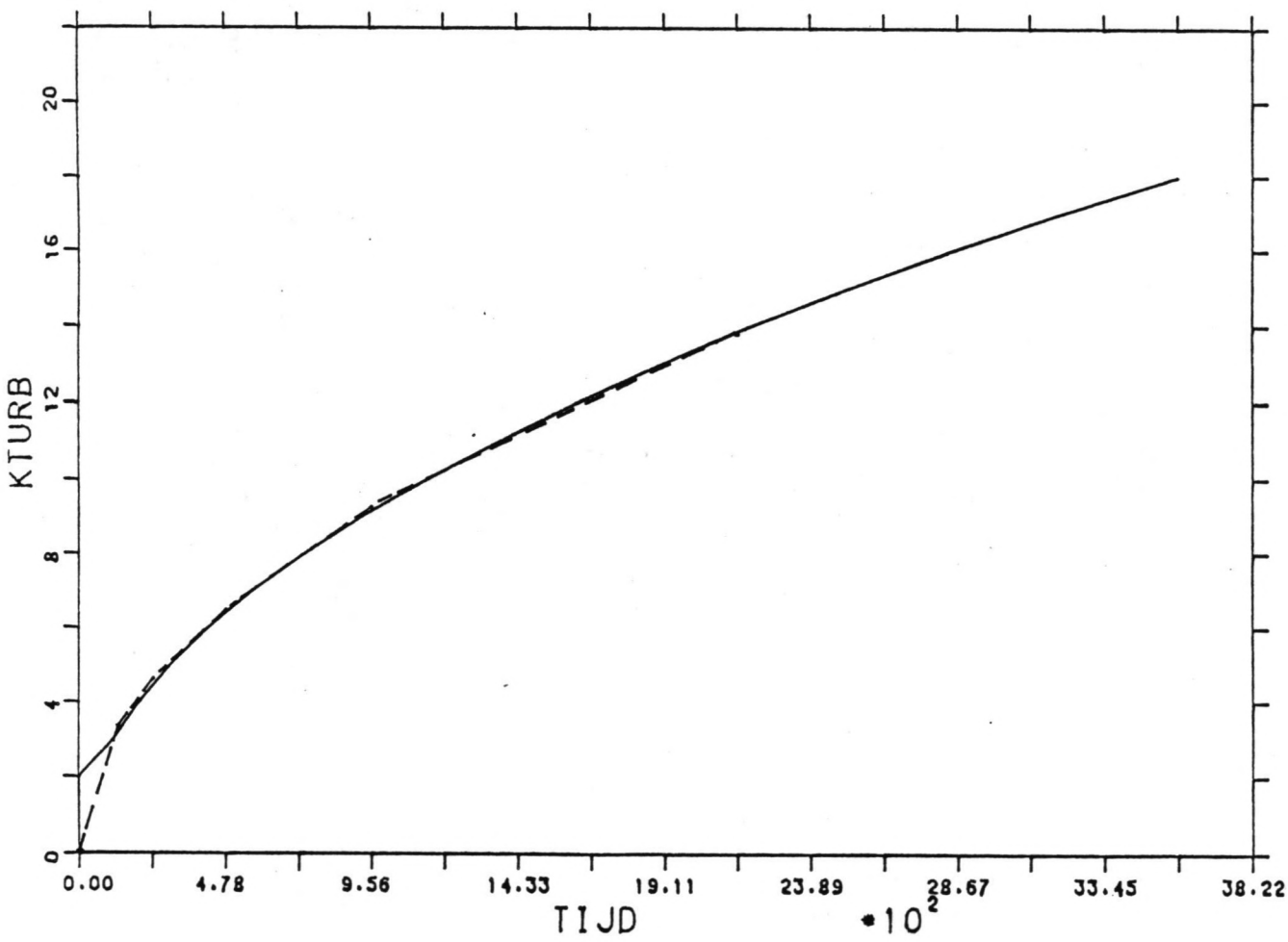

FIG 20

OORSPRONKELIJK LINEAIR DICHTHEIDSPROFIEL

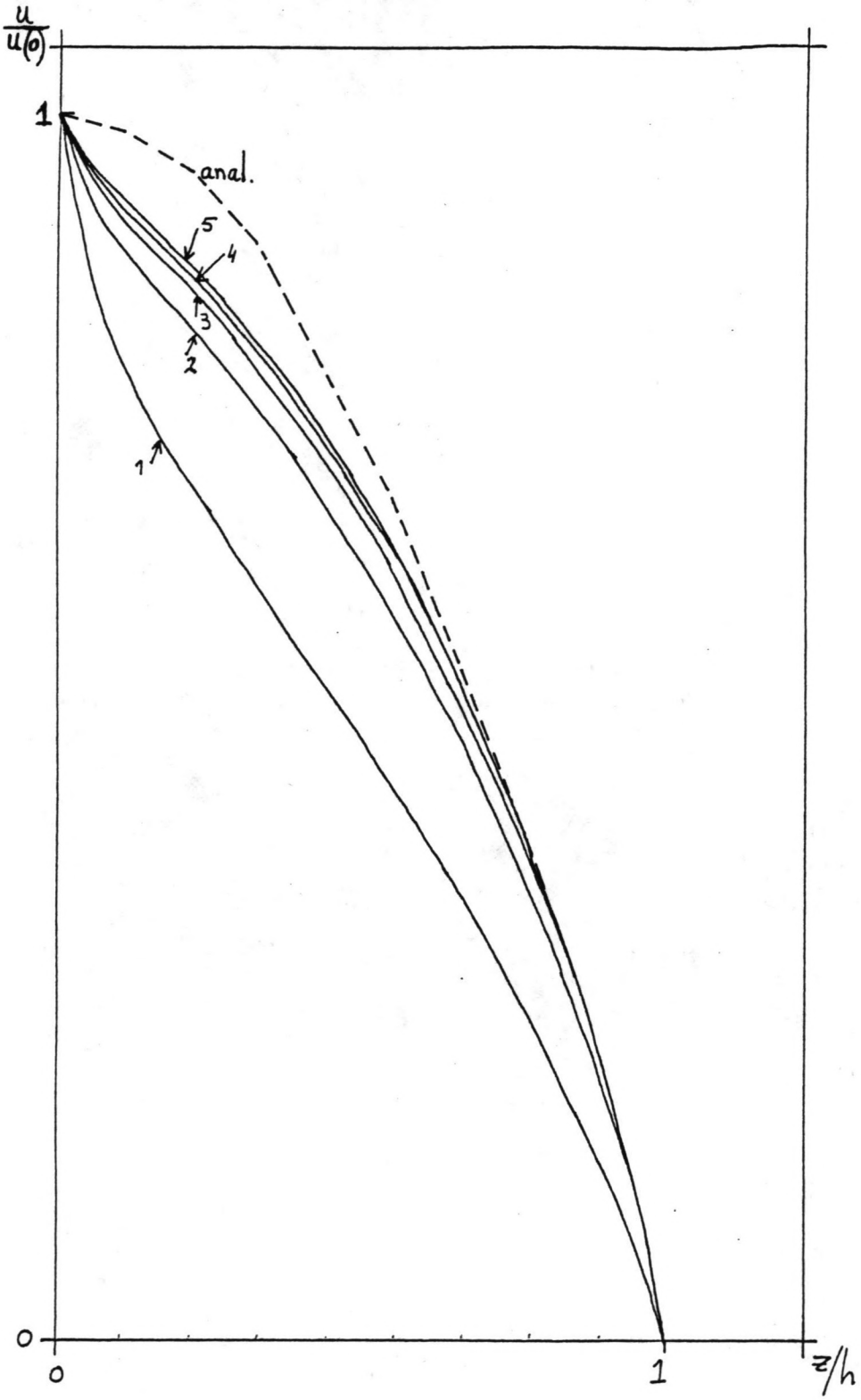

FIG 22
VARIATIE IN GELAAGDHEID

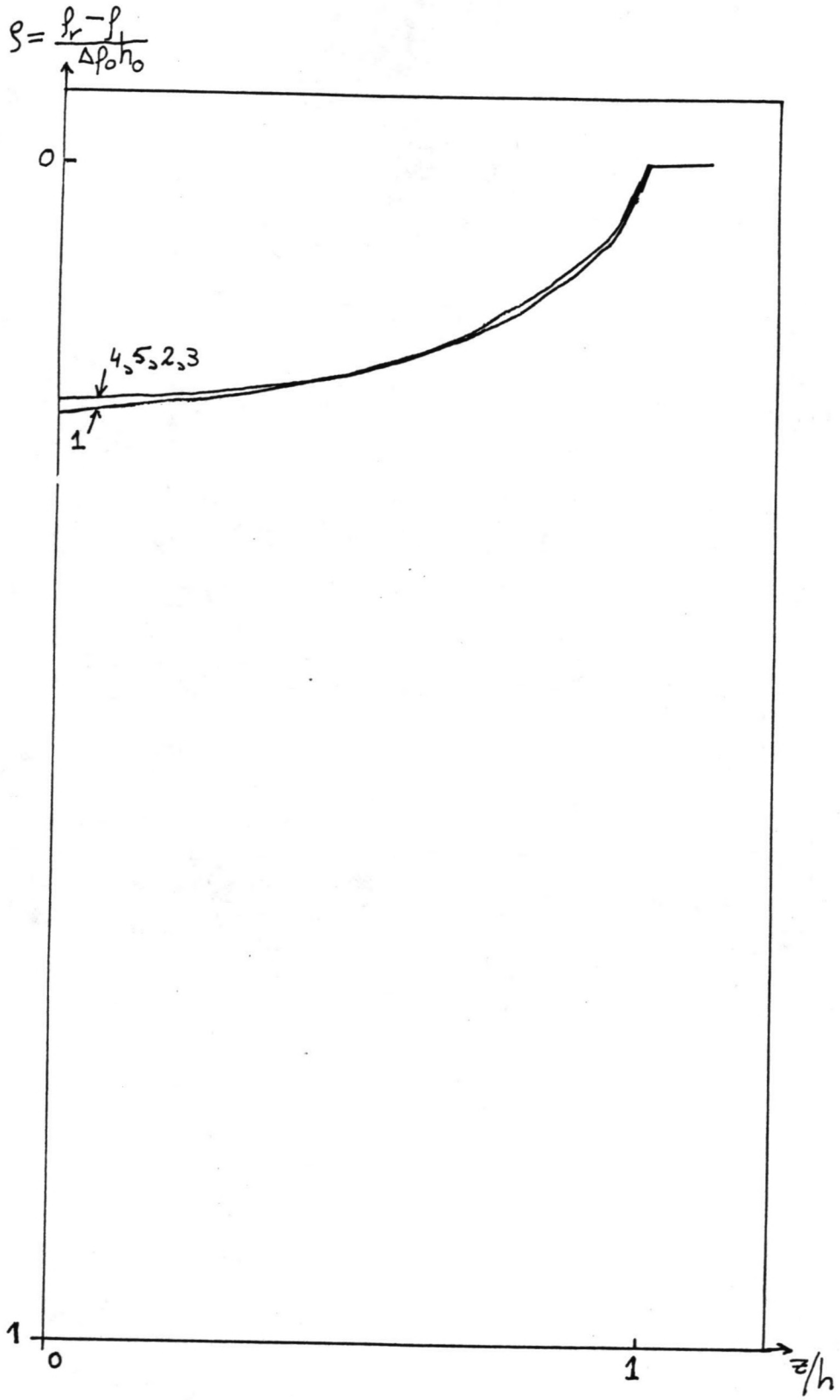

FIG 21
VARIATIE IN GELAAGDHEID

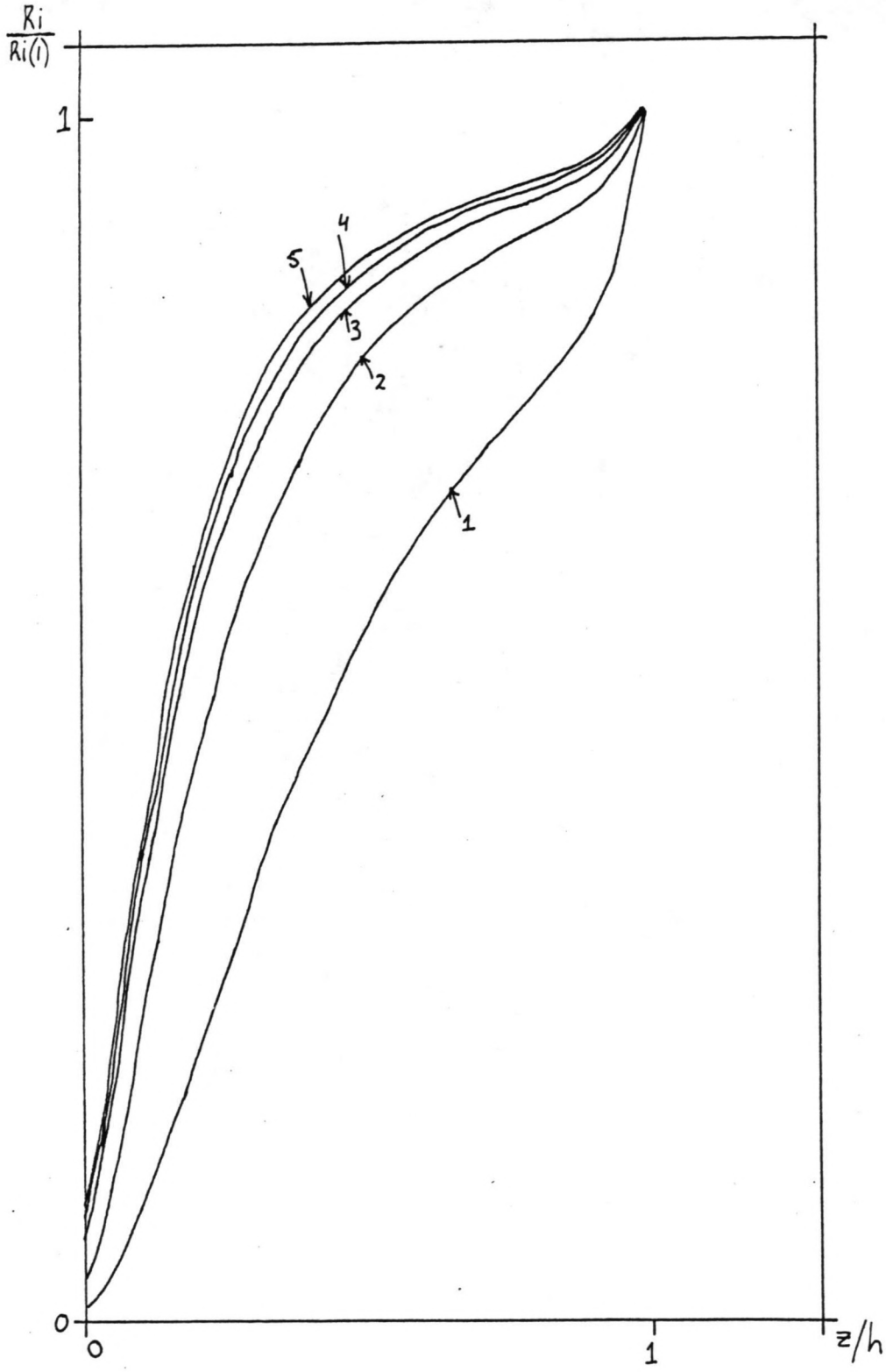

FIG 23
VARIATIE IN GELAAGDHEID

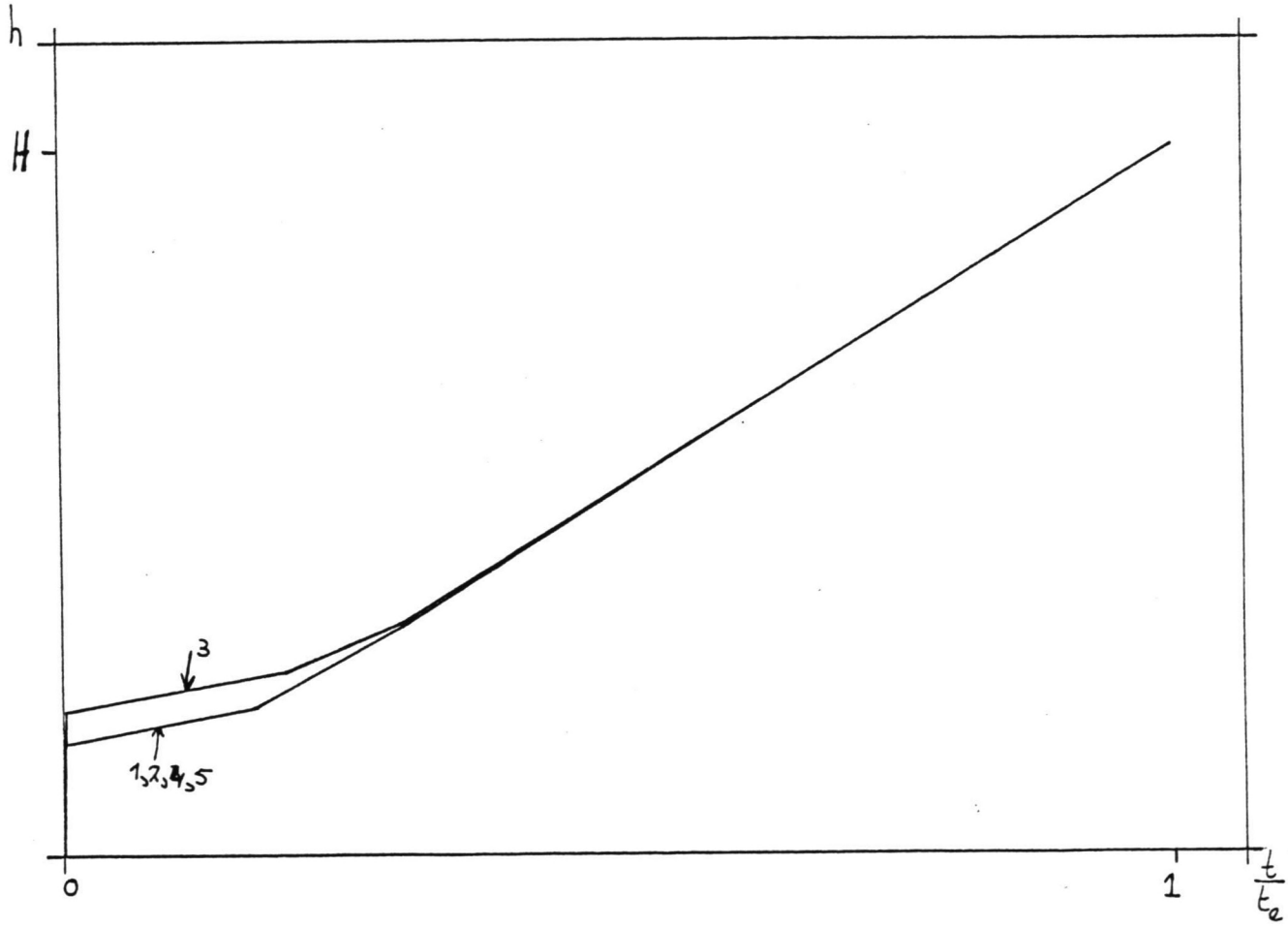

FIG 24

VARIATIE IN GELAAGDHEID

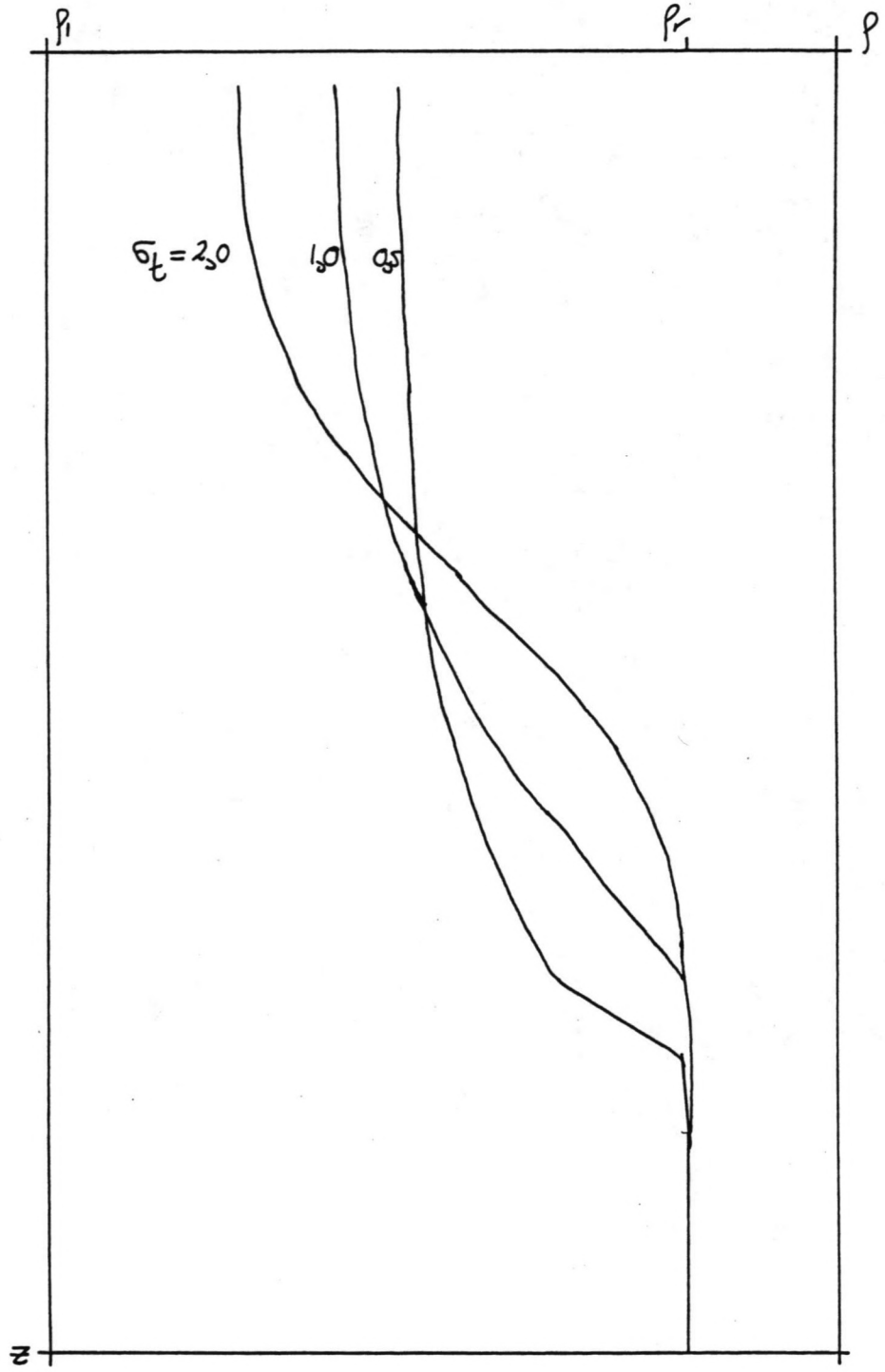

FIG 25
VARIATIE VAN σ_t
NUMERIEKE BEREKENING

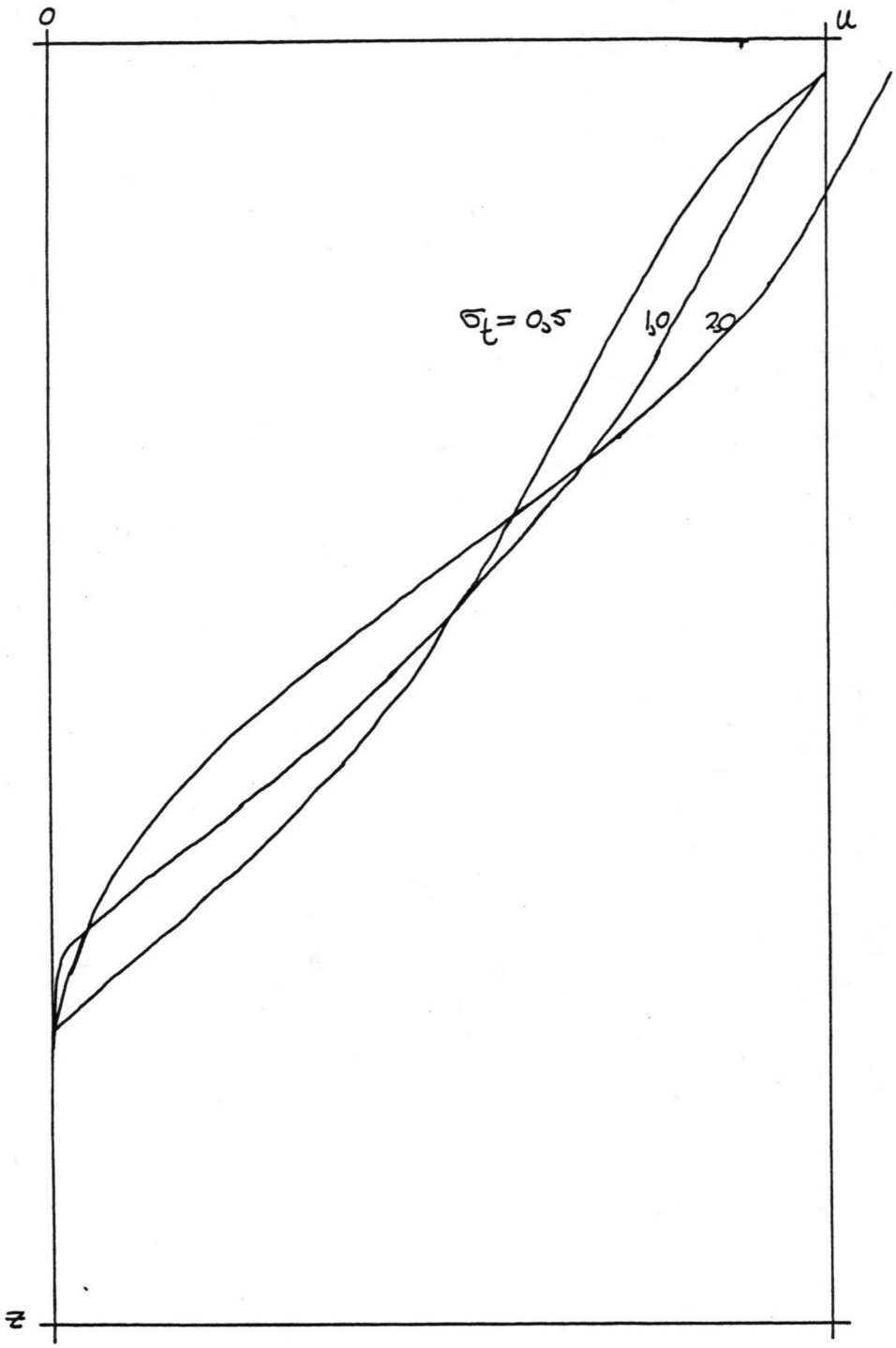

FIG 26

VARIATIE VAN σ_t

NUMERIEKE BEREKENING

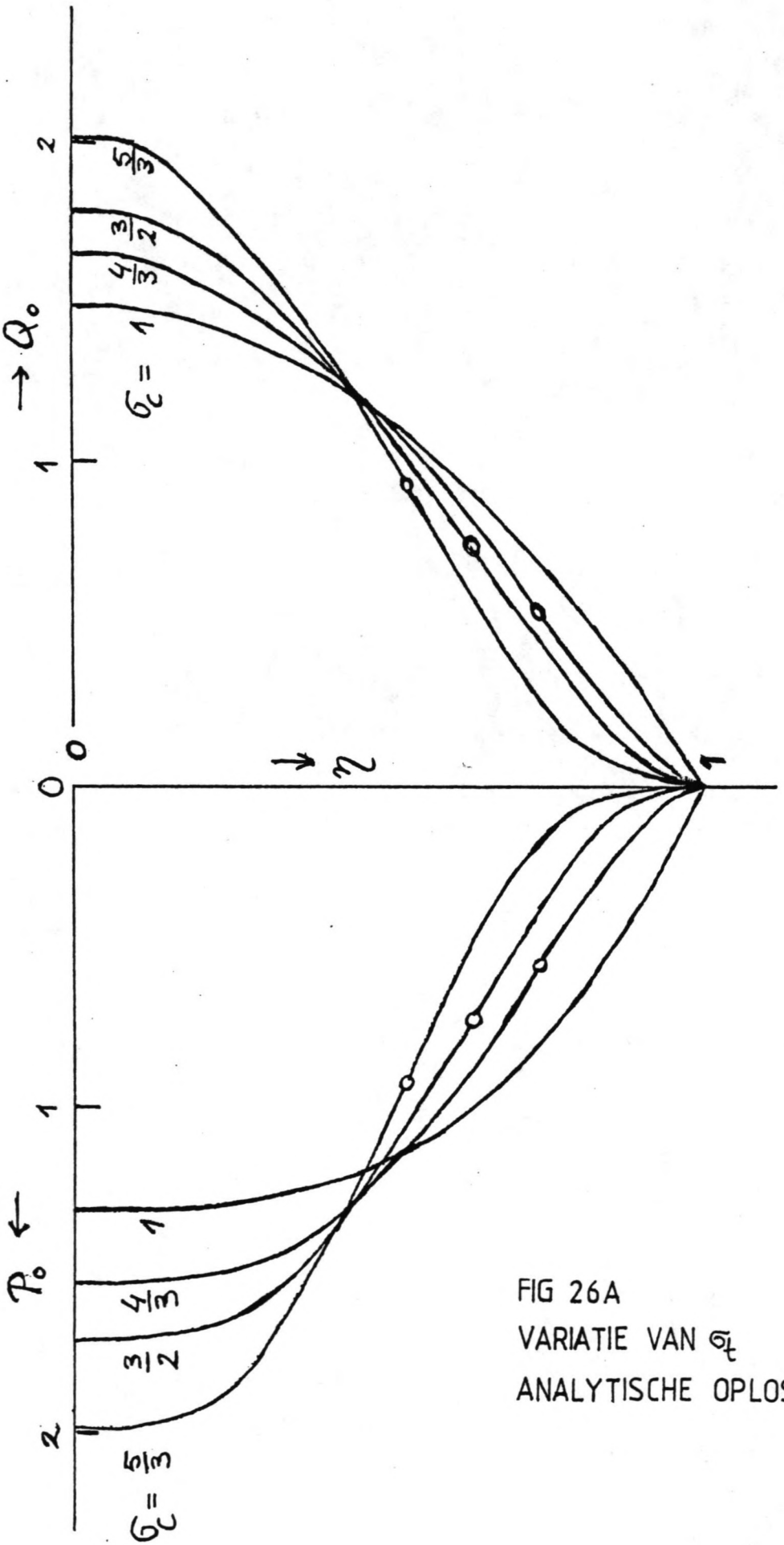

FIG 26A
VARIATIE VAN σ_t
ANALYTISCHE OPLOSSING

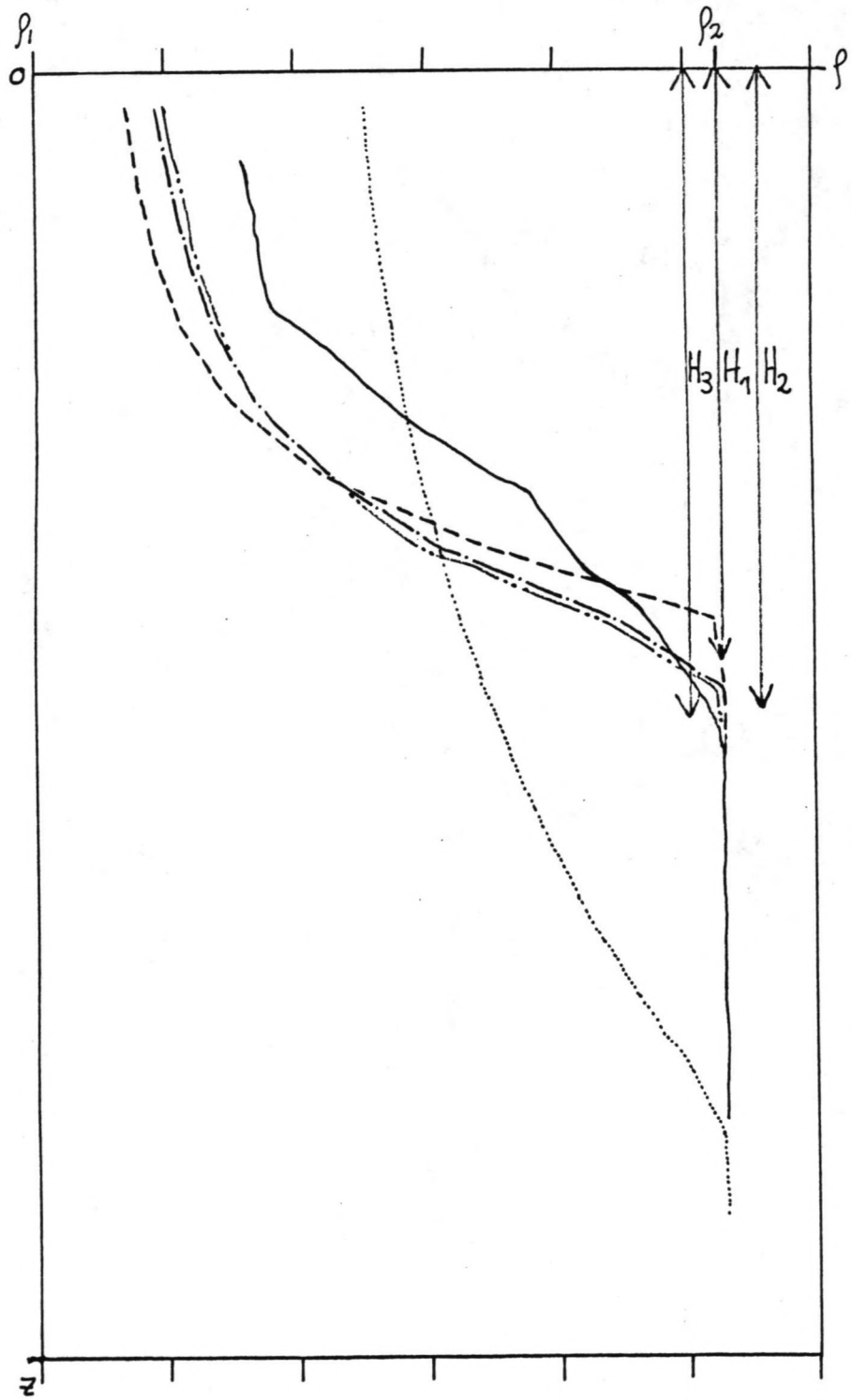

FIG 27

EXP 1 t = 130 SEC

——— METING
- - - - - - - DIFF. MODEL
—·—·—·— M.W.L.MODEL
..... K1-MODEL
——··—— K2-MODEL

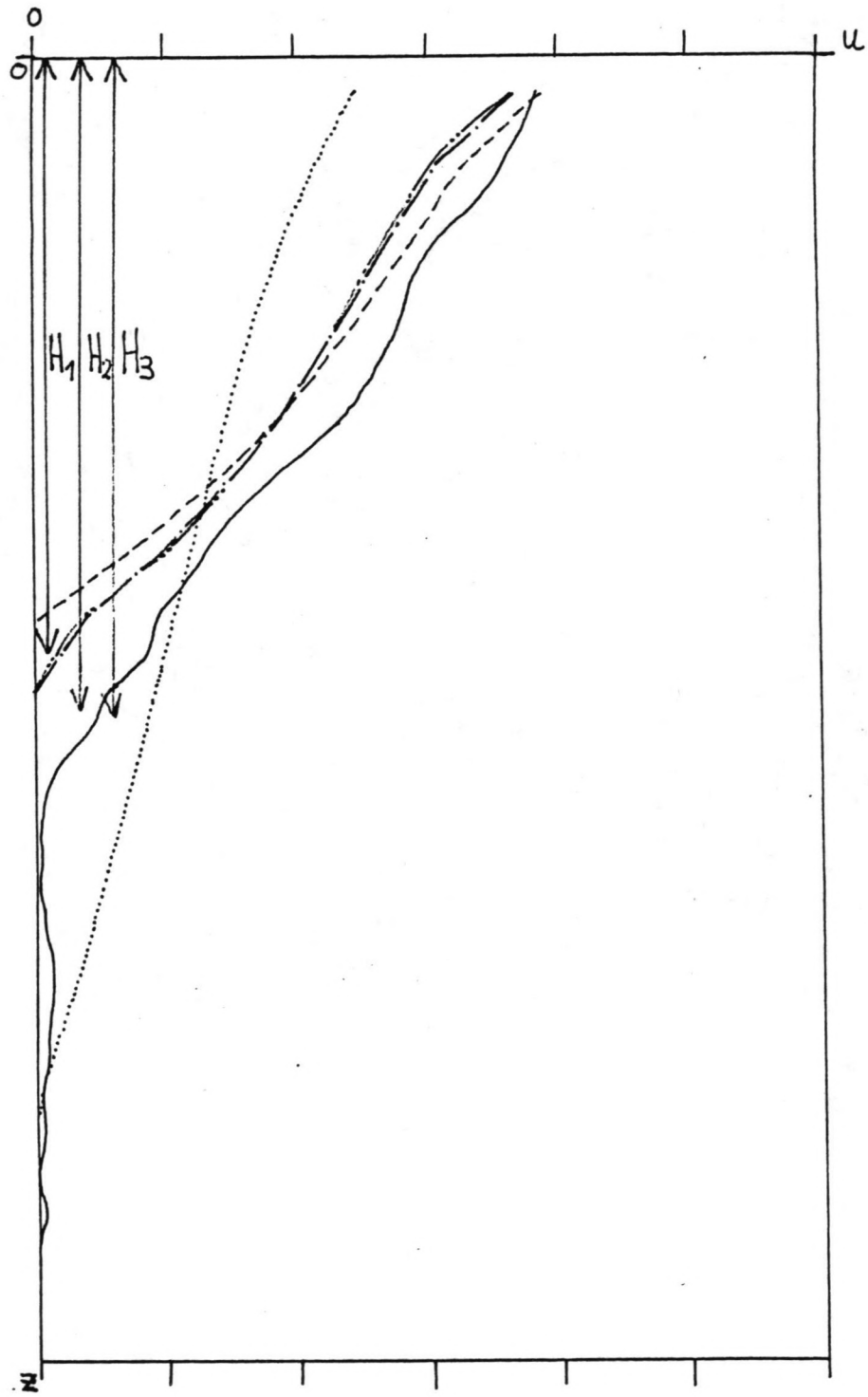

FIG 28

EXP 1 t = 130 SEC

——— METING
- - - - - - - DIFF. MODEL
—·—·—·— M.W.L.MODEL
..... K1-MODEL
——··—— K2-MODEL

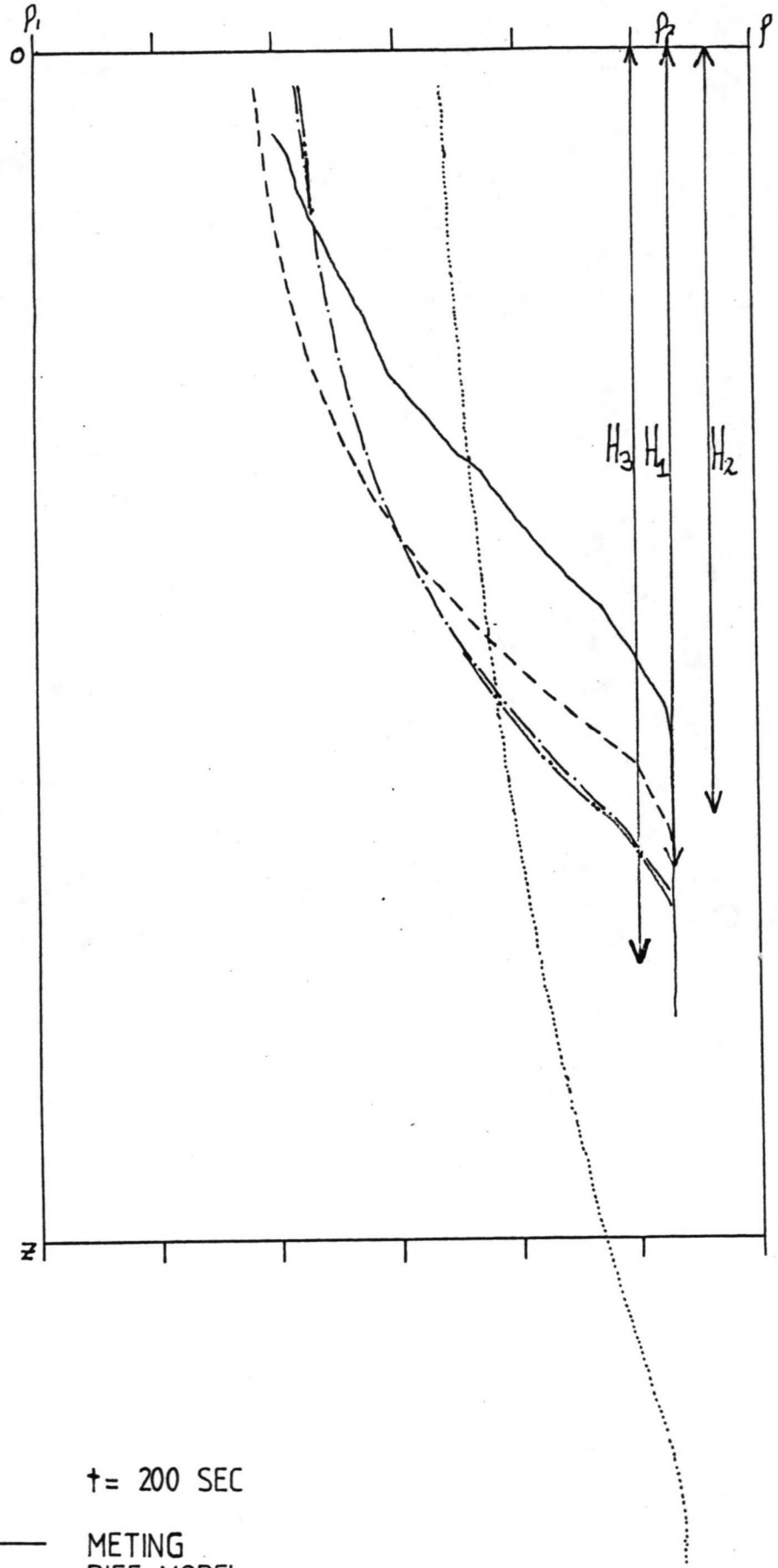

FIG 29

EXP 1 t= 200 SEC

——— METING
- - - - - - - DIFF. MODEL
—·—·—·— M.W.L.MODEL
..... K1-MODEL
——··—— K2-MODEL

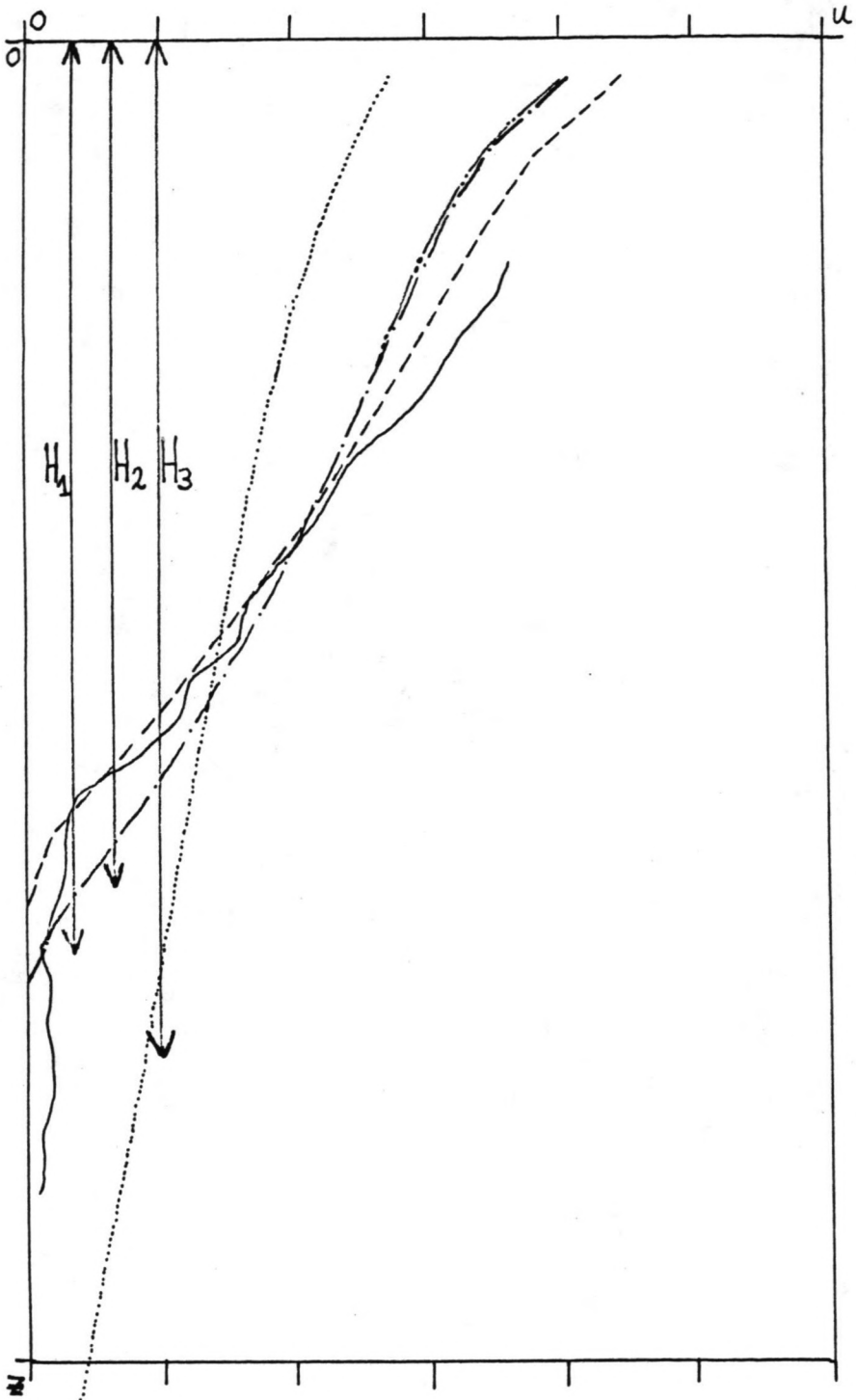

FIG 30

EXP 1 t= 200 SEC

METING
DIFF. MODEL
M.W.L.MODEL
K1-MODEL
K2-MODEL

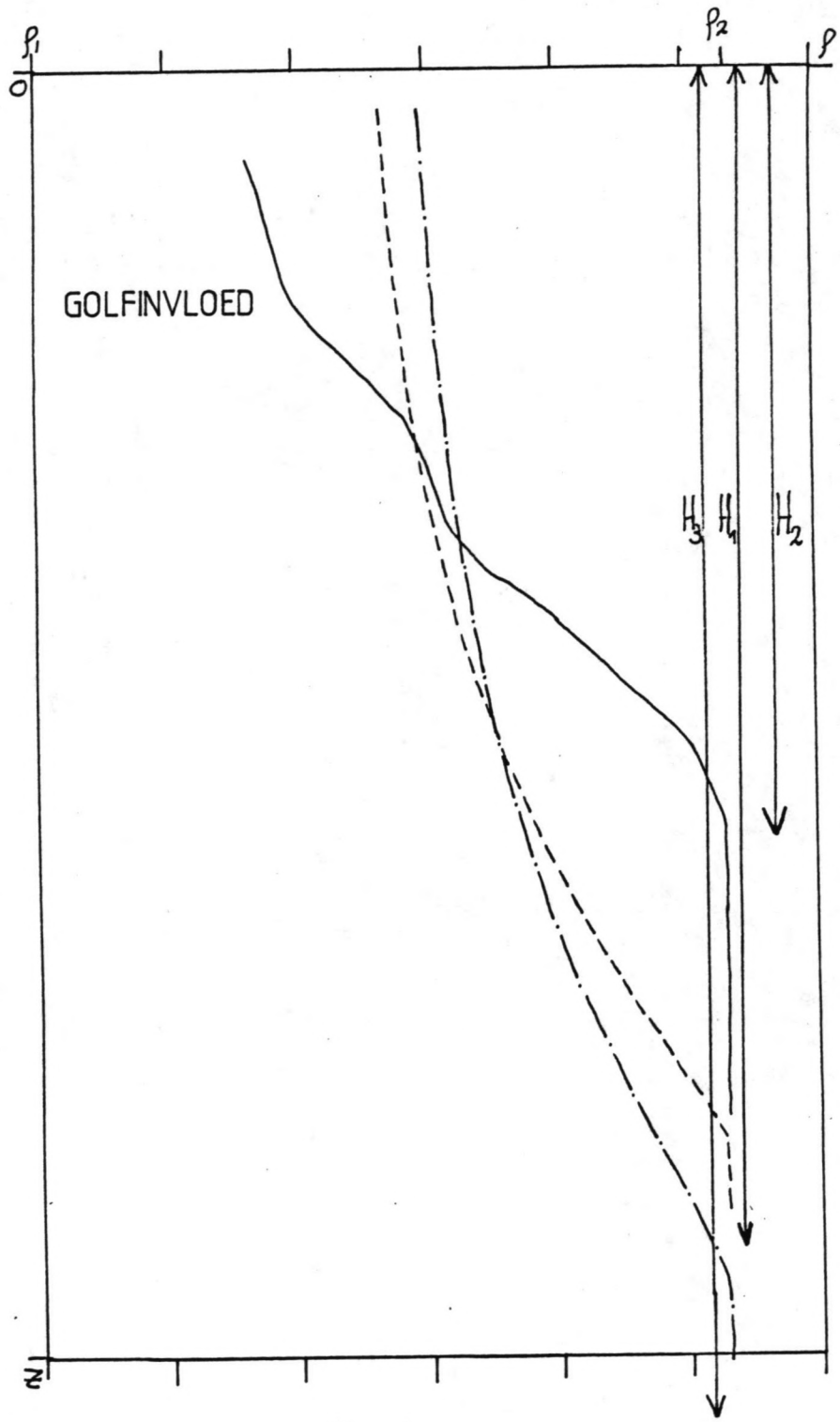

FIG 31

EXP1 t = 270 SEC

——— METING
- - - - - - DIFF. MODEL
—·—·—· M.W.L.-EN K2-MODEL

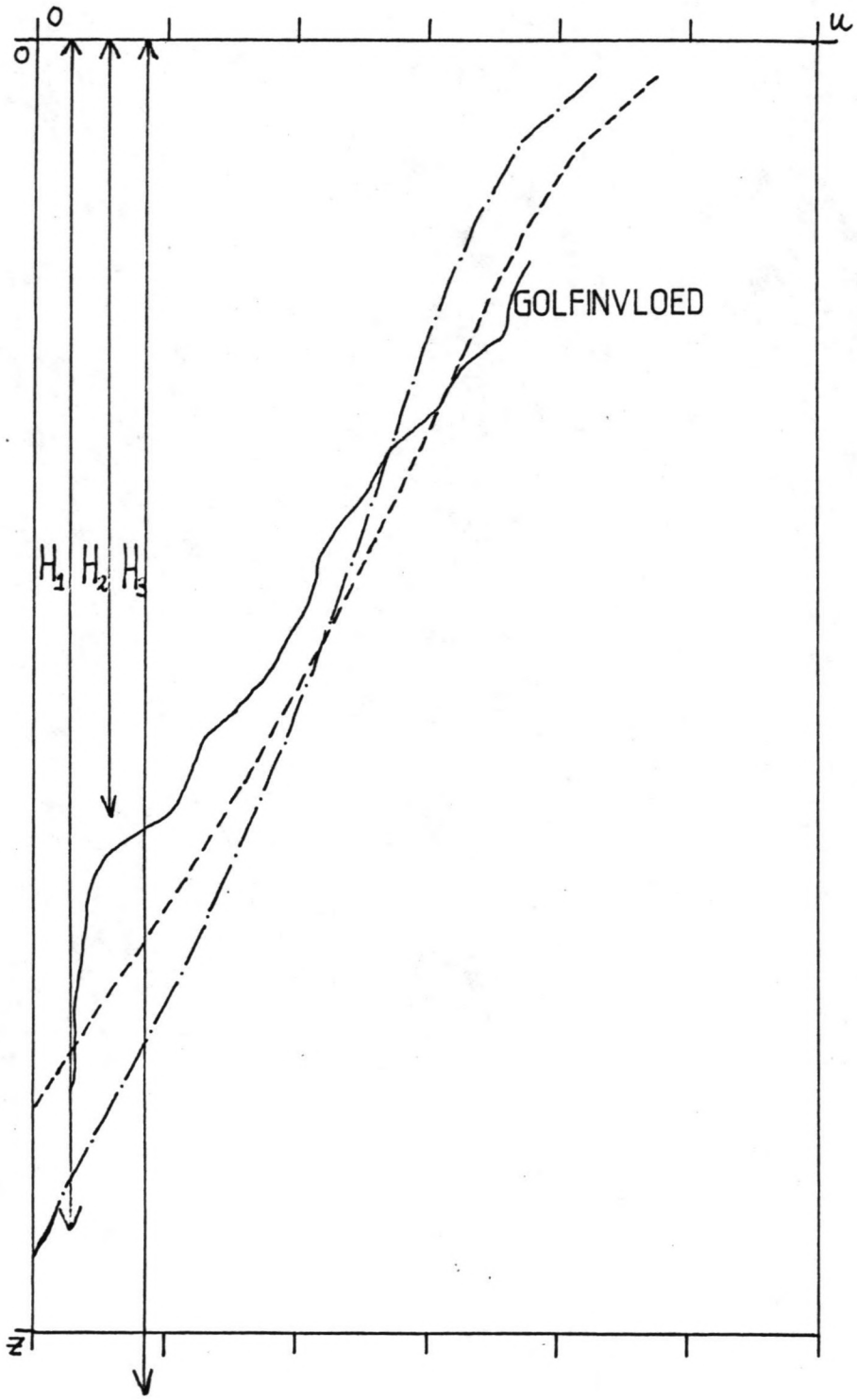

FIG 32

EXP 1 t = 270 SEC

——— METING
- - - - - - DIFF. MODEL
—·—·—· M.W.L.-EN K2-MODEL

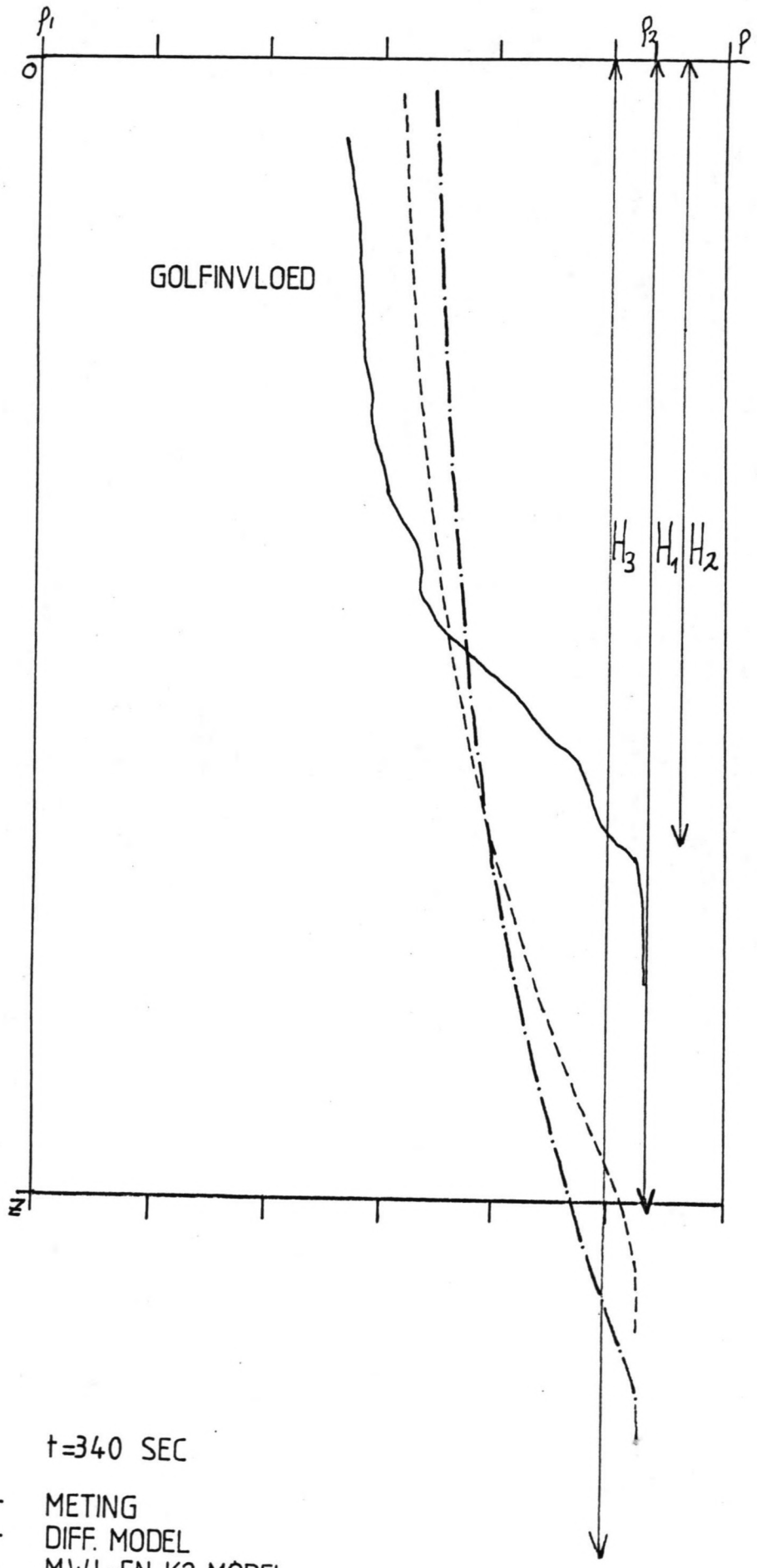

FIG 33

EXP 1 t=340 SEC

——— METING
- - - - - - DIFF. MODEL
—·—·— M.W.L.-EN K2-MODEL

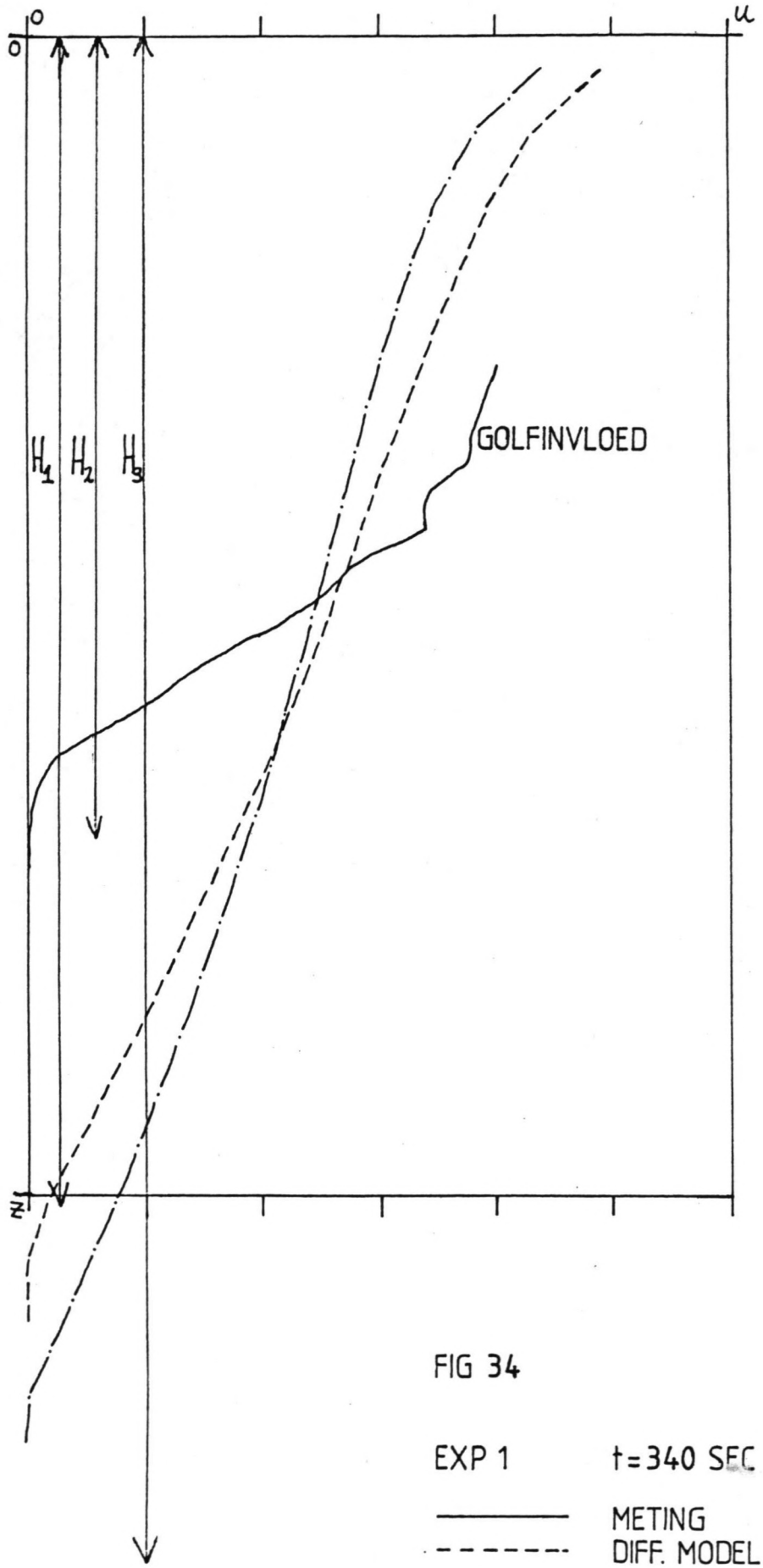

FIG 34

EXP 1 t=340 SEC

METING
DIFF. MODEL
M.W.L.-EN K2-MODEL

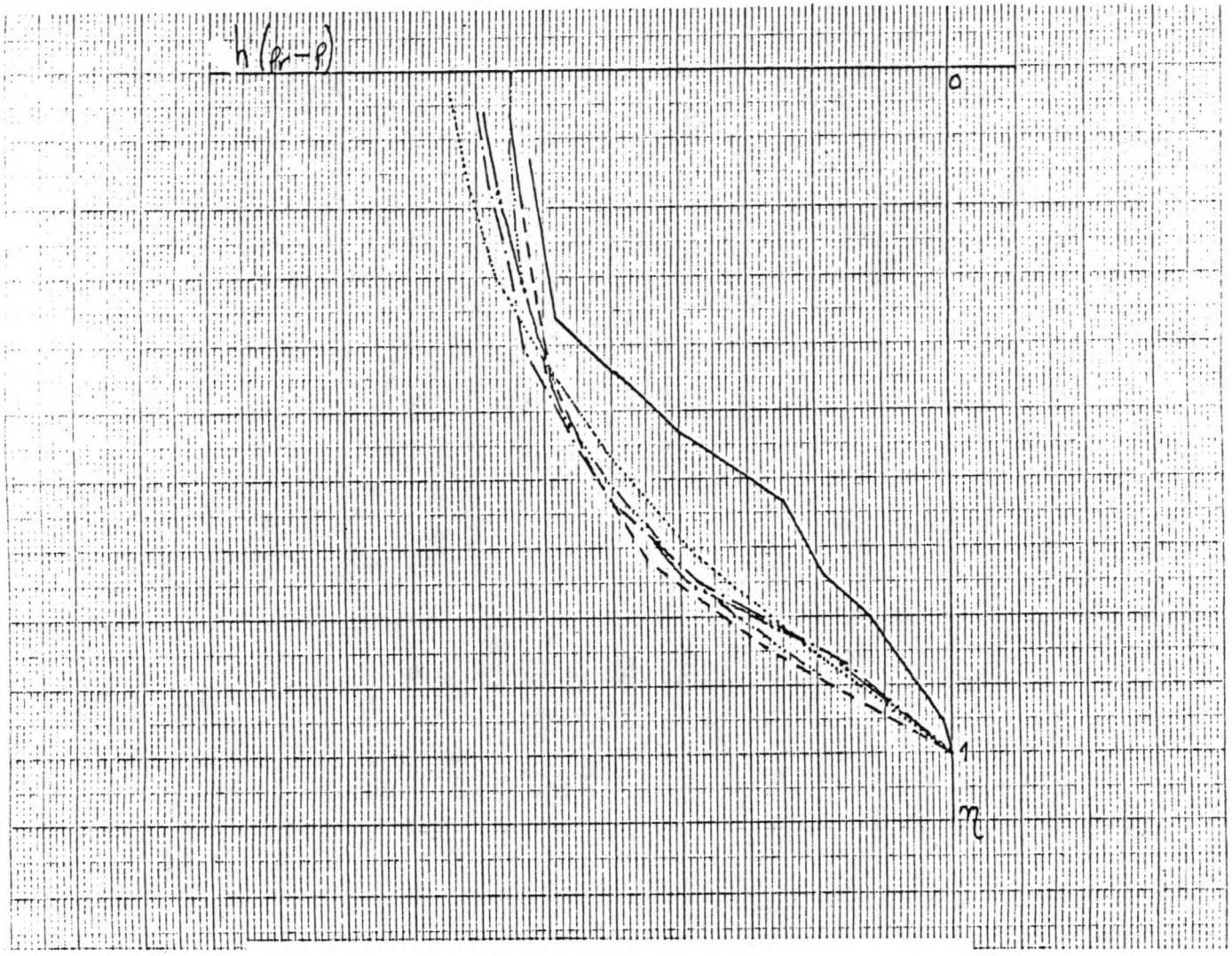

FIG 35

EXP1 t = 130 SEC

——————— METING
- - - - - - - - DIFF. MODEL
— · — · — · — M.W.L.MODEL
..... K1-MODEL
—— ·· —— K2-MODEL
—·····—·····— ANAL.OPL..

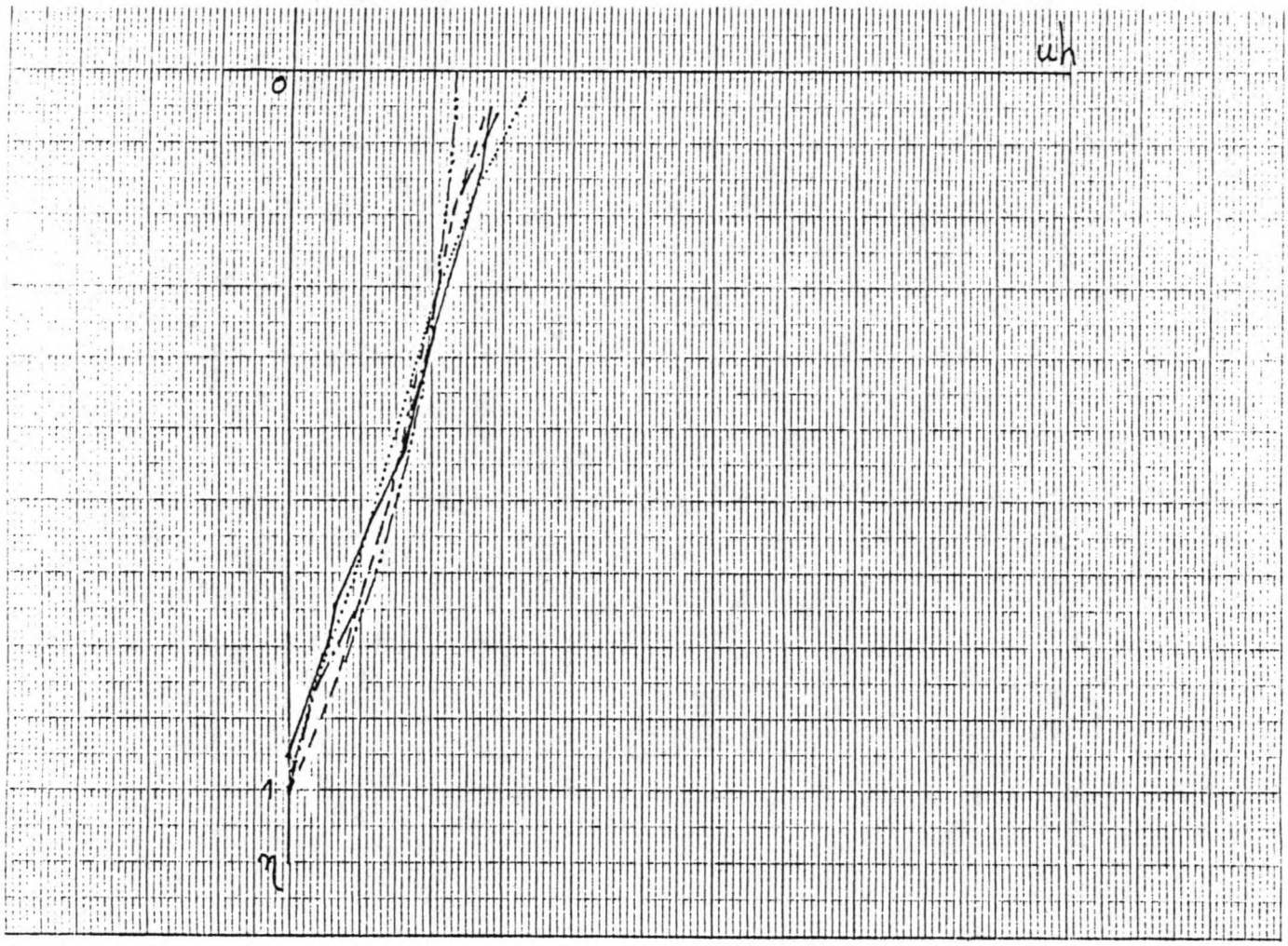

FIG 36

EXP1 t=130 SEC

——— METING
- - - - - - DIFF. MODEL
—·—·—· M.W.L.-EN K2-MODEL
..... K1-MODEL
—··—··—·· ANAL. OPL.

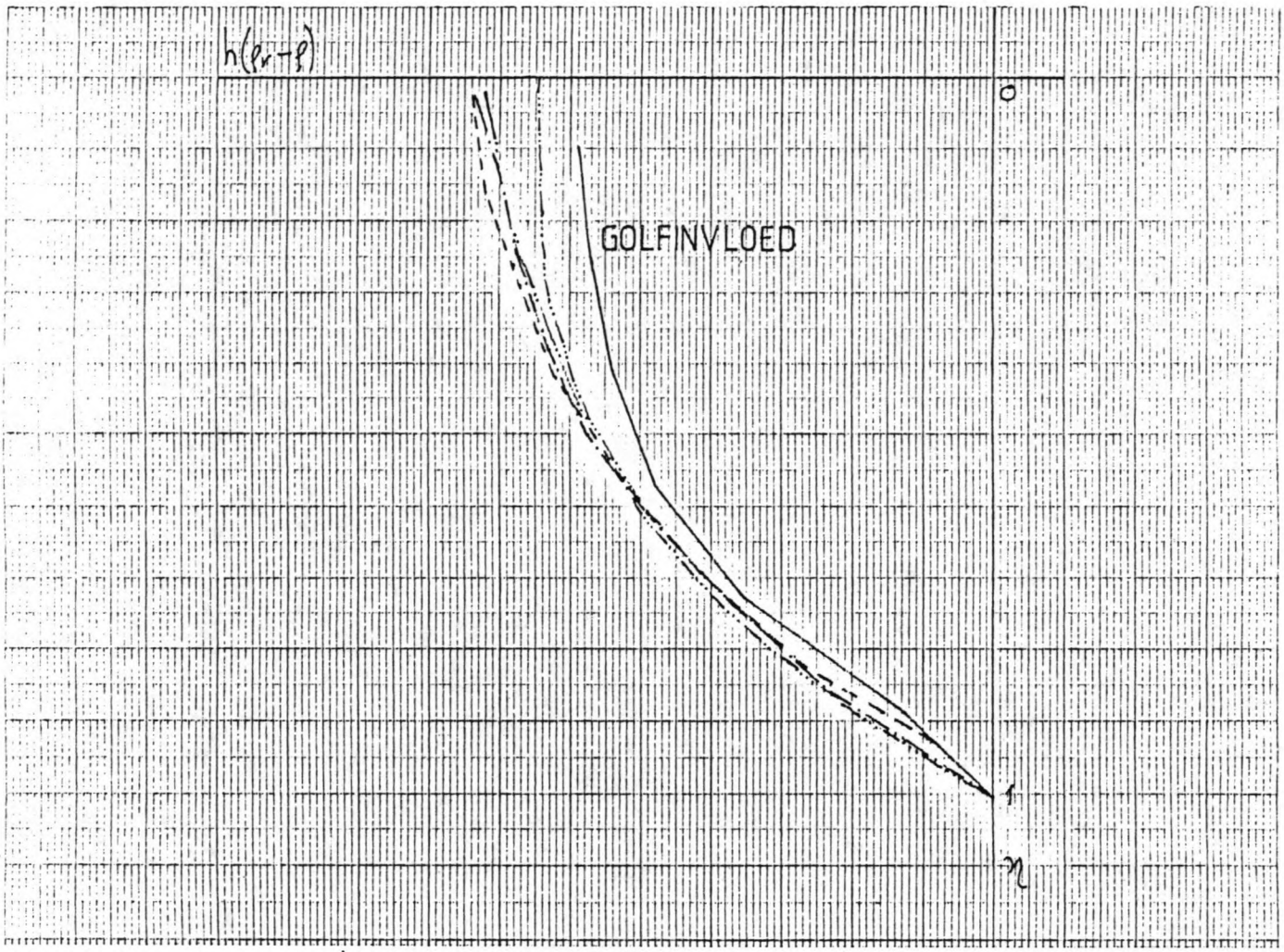

FIG 37

EXP 1 t = 340 SEC

——— METING
- - - - - - - DIFF. MODEL
—·—·—·— M.W.L.MODEL
..... K1-MODEL
——··—— K2-MODEL
—···—···— ANAL.OPL..

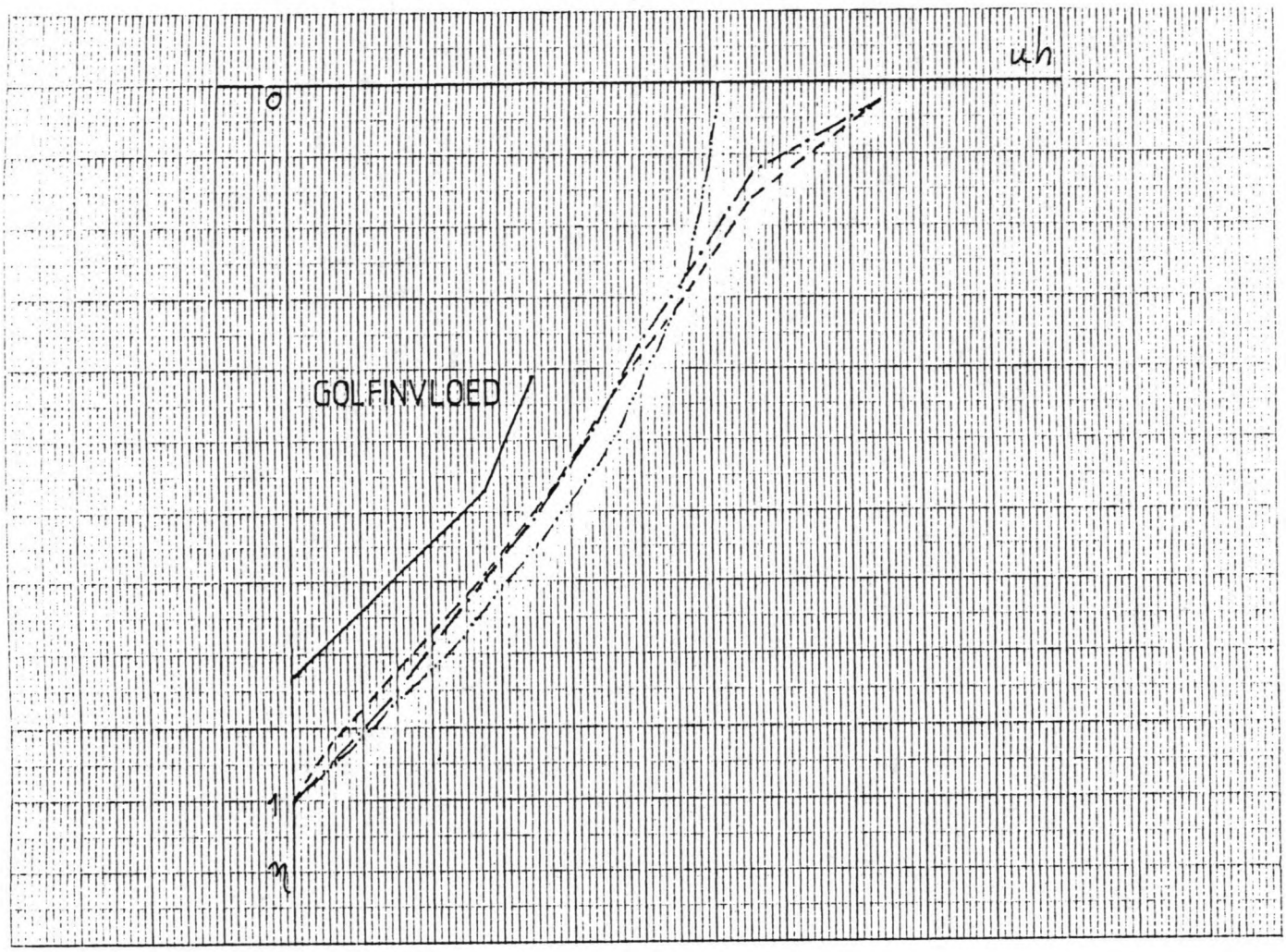

FIG 38

EXP 1 t=340 SEC

——— METING
- - - - - - DIFF. MODEL
—·—·—· M.W.L-EN K2-MODEL
..... K1-MODEL
—·—··—·— ANAL. OPL.

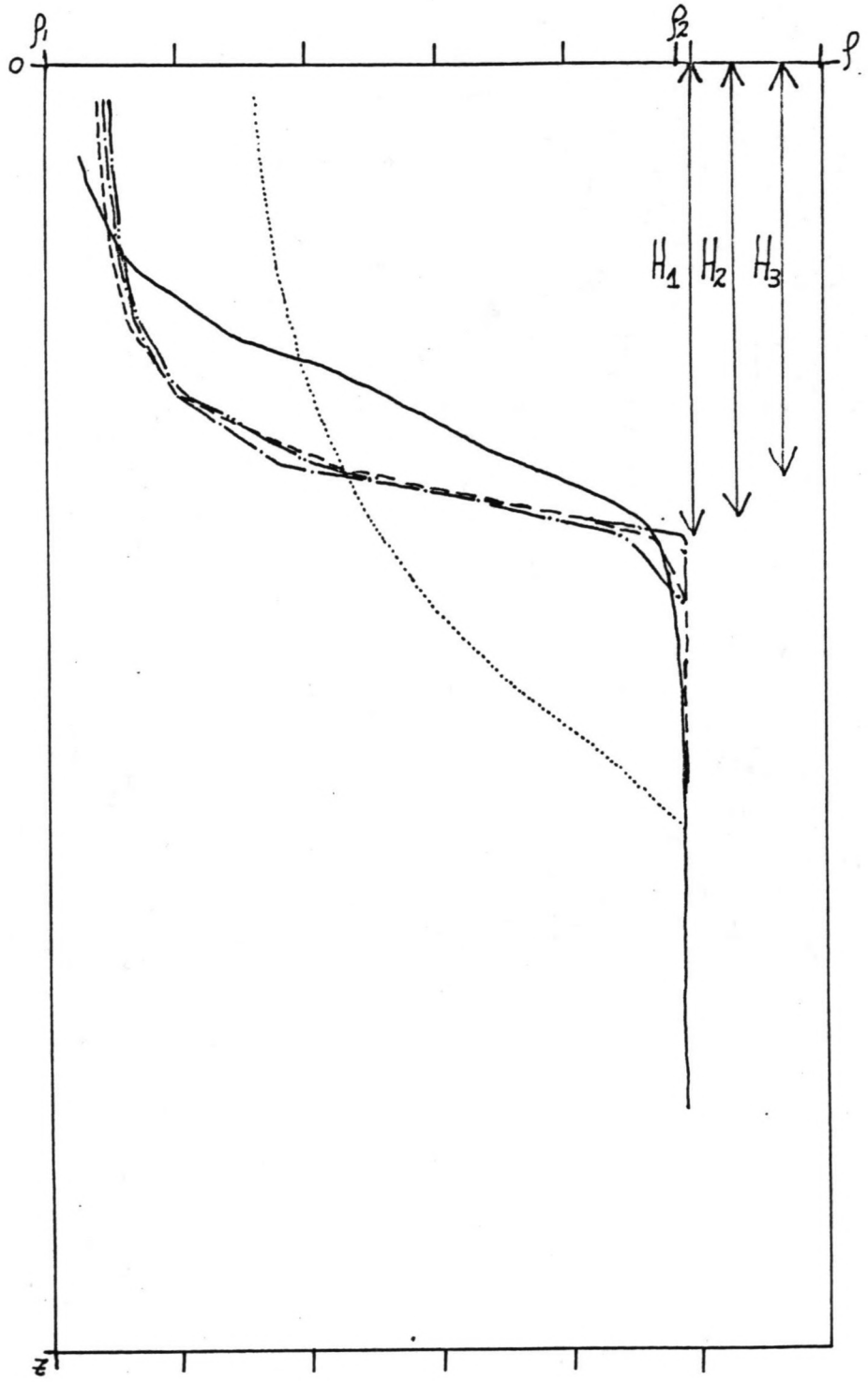

FIG 39

EXP 2 t = 280 SEC

——— METING
- - - - - - - DIFF. MODEL
—·—·—·— M.W.L.MODEL
..... K1-MODEL
——··—— K2-MODEL

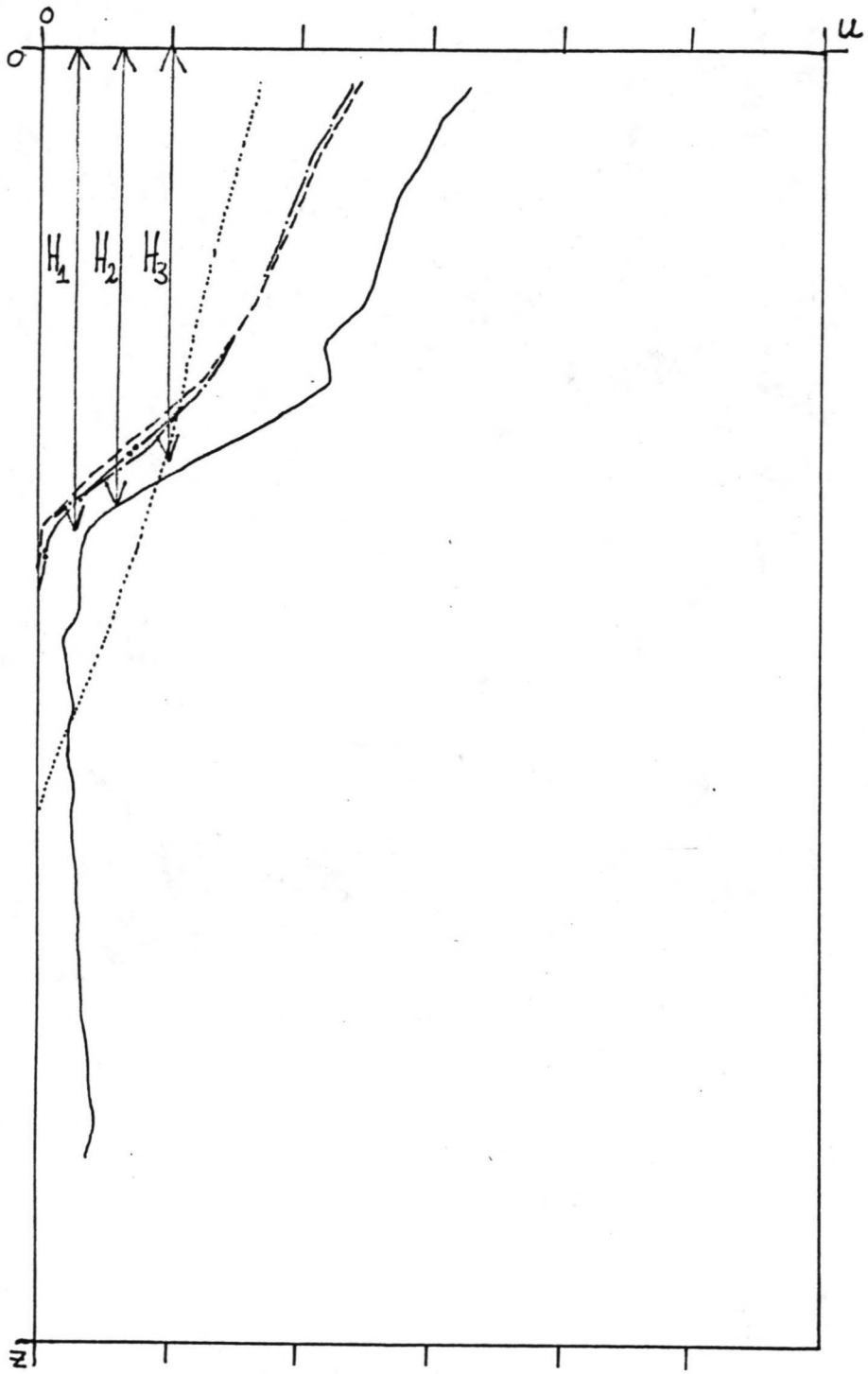

FIG 40

EXP 2 t = 280 SEC

——— METING
- - - - - - - DIFF. MODEL
—·—·—·— M.W.L.MODEL
..... K1-MODEL
——··—— K2-MODEL

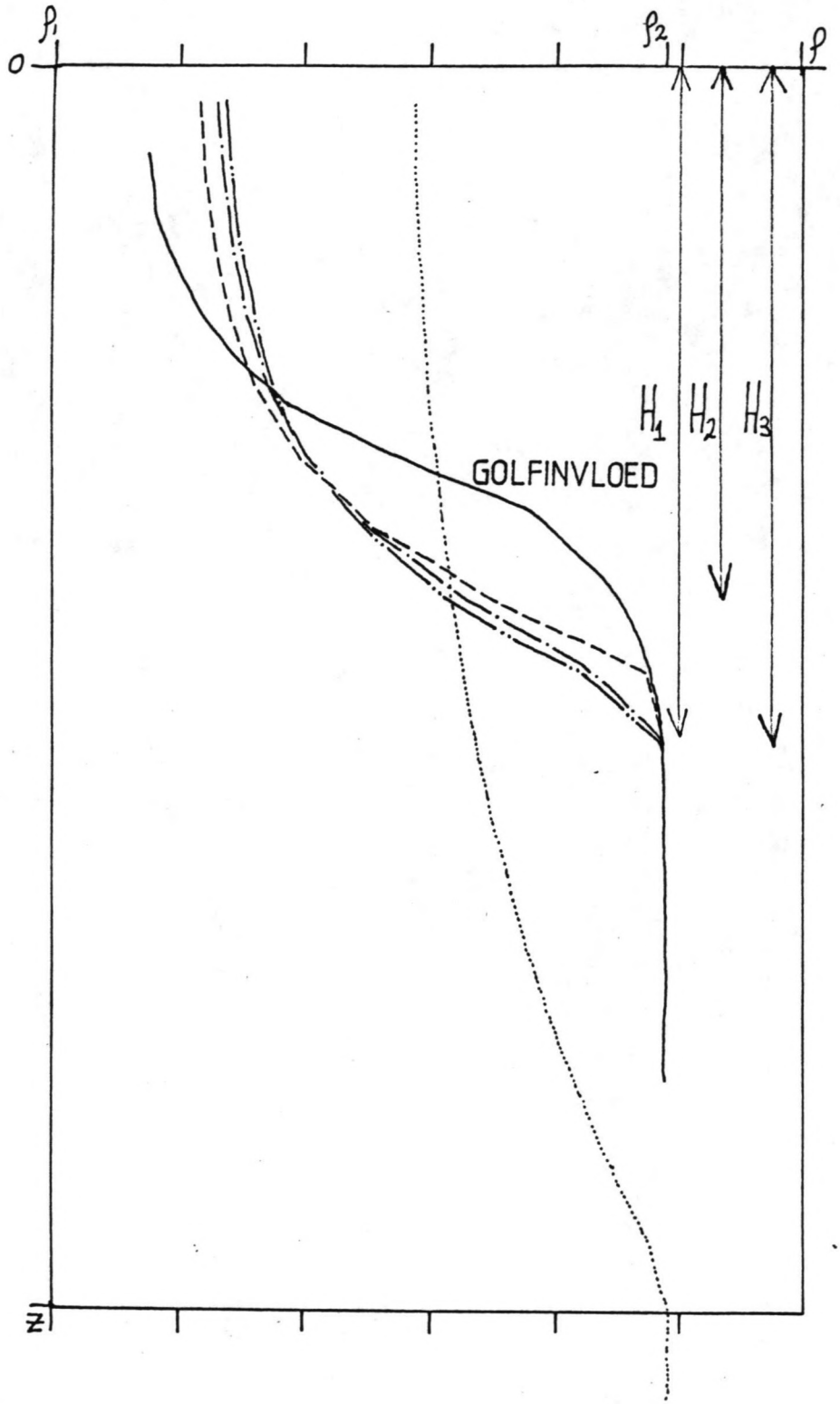

FIG 41

EXP 2 t = 480 SEC

METING
DIFF. MODEL
M.W.L.MODEL
K1-MODEL
K2-MODEL

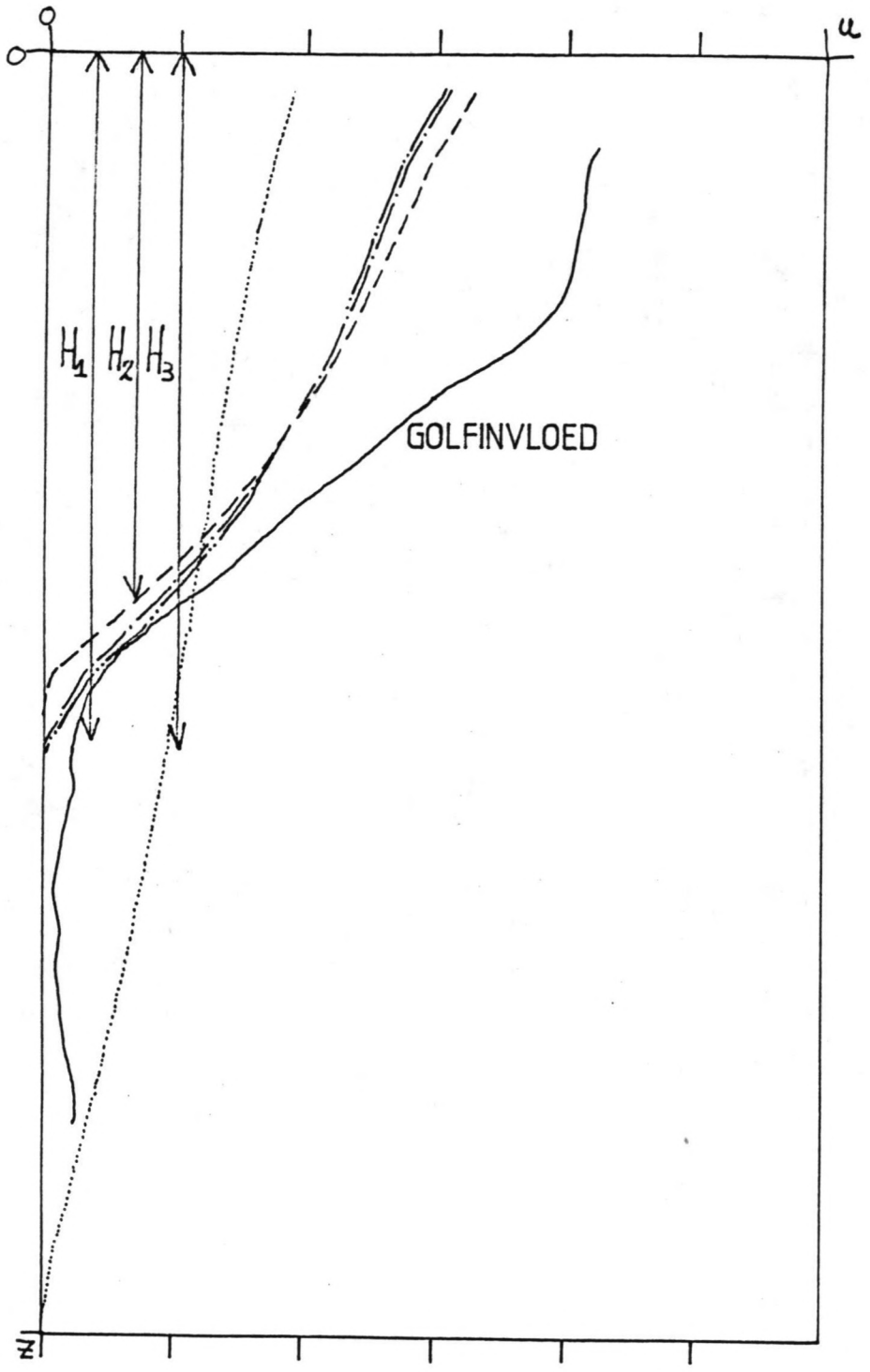

FIG 42

EXP 2 t = 480 SEC

METING
DIFF. MODEL
M.W.L.MODEL
K1-MODEL
K2-MODEL

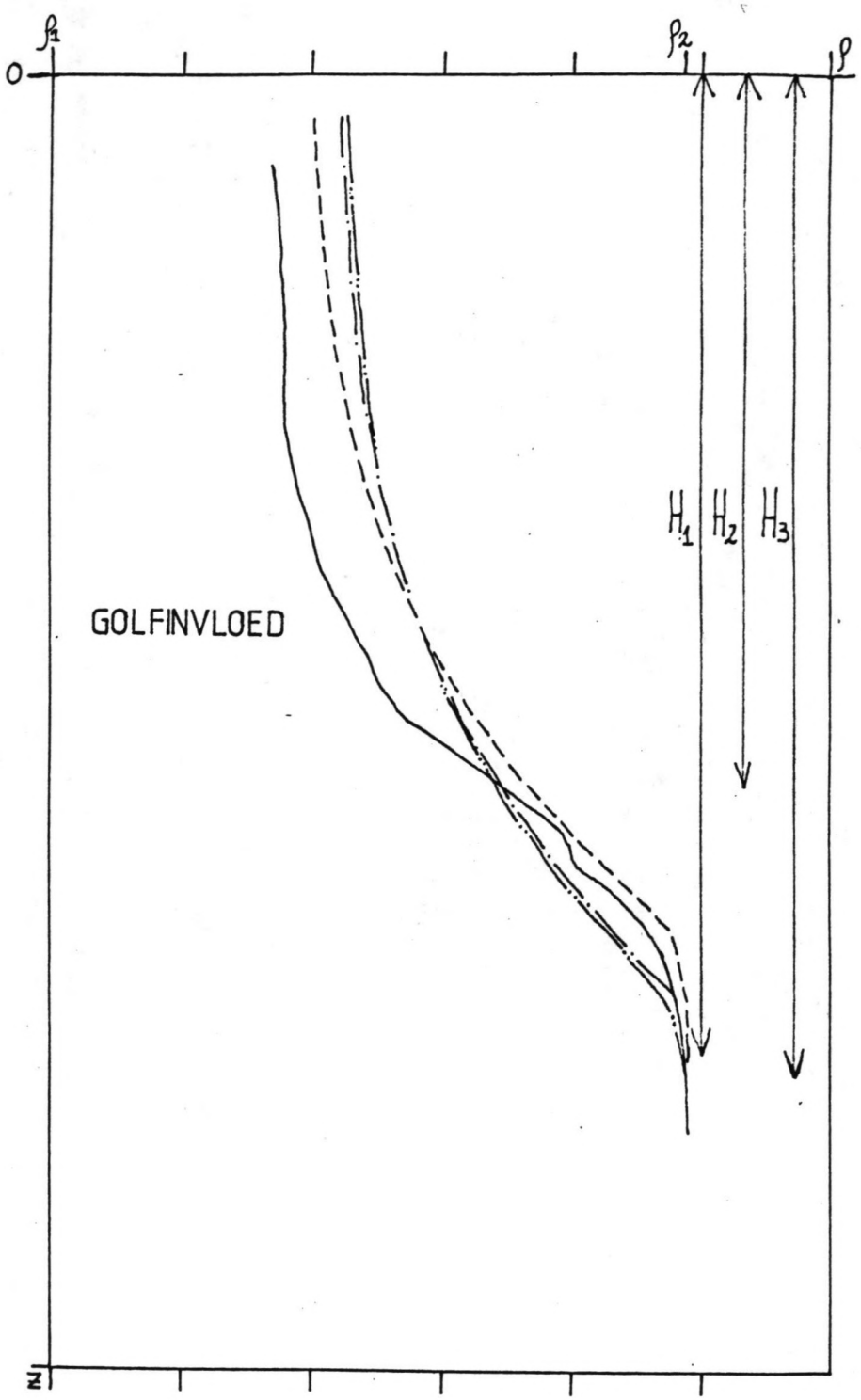

FIG 43

EXP 2 t=680 SEC

——— METING
- - - - - - - DIFF. MODEL
—·—·—·— M.W.L.MODEL

——··—— K2-MODEL

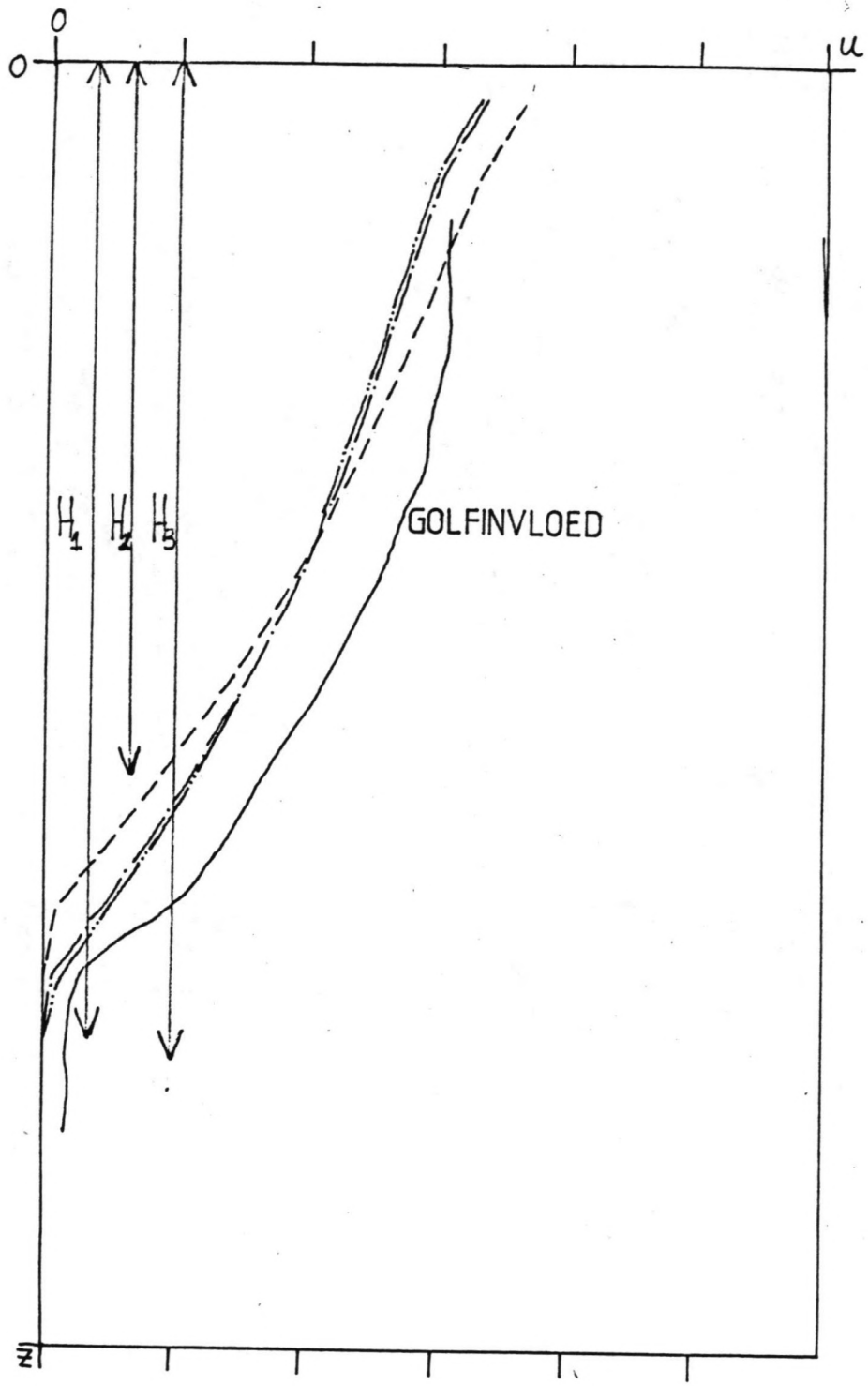

FIG 44

EXP 2 t = 680 SEC

METING
DIFF. MODEL
M.W.L.MODEL
K2-MODEL

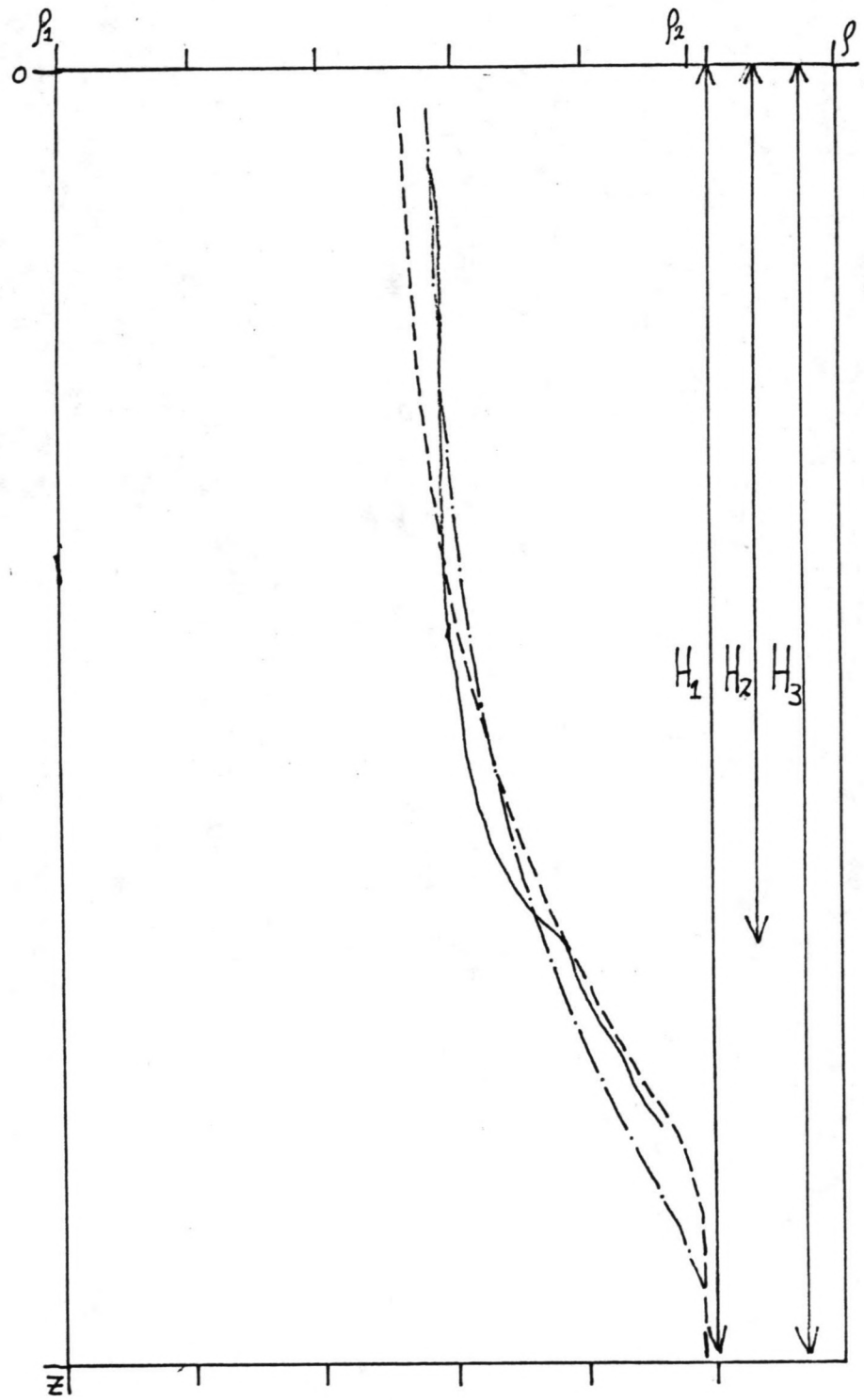

FIG 45

EXP 2 t=880 SEC

——— METING
- - - - - - DIFF. MODEL
—·—·—· M.W.L.-EN K2-MODEL

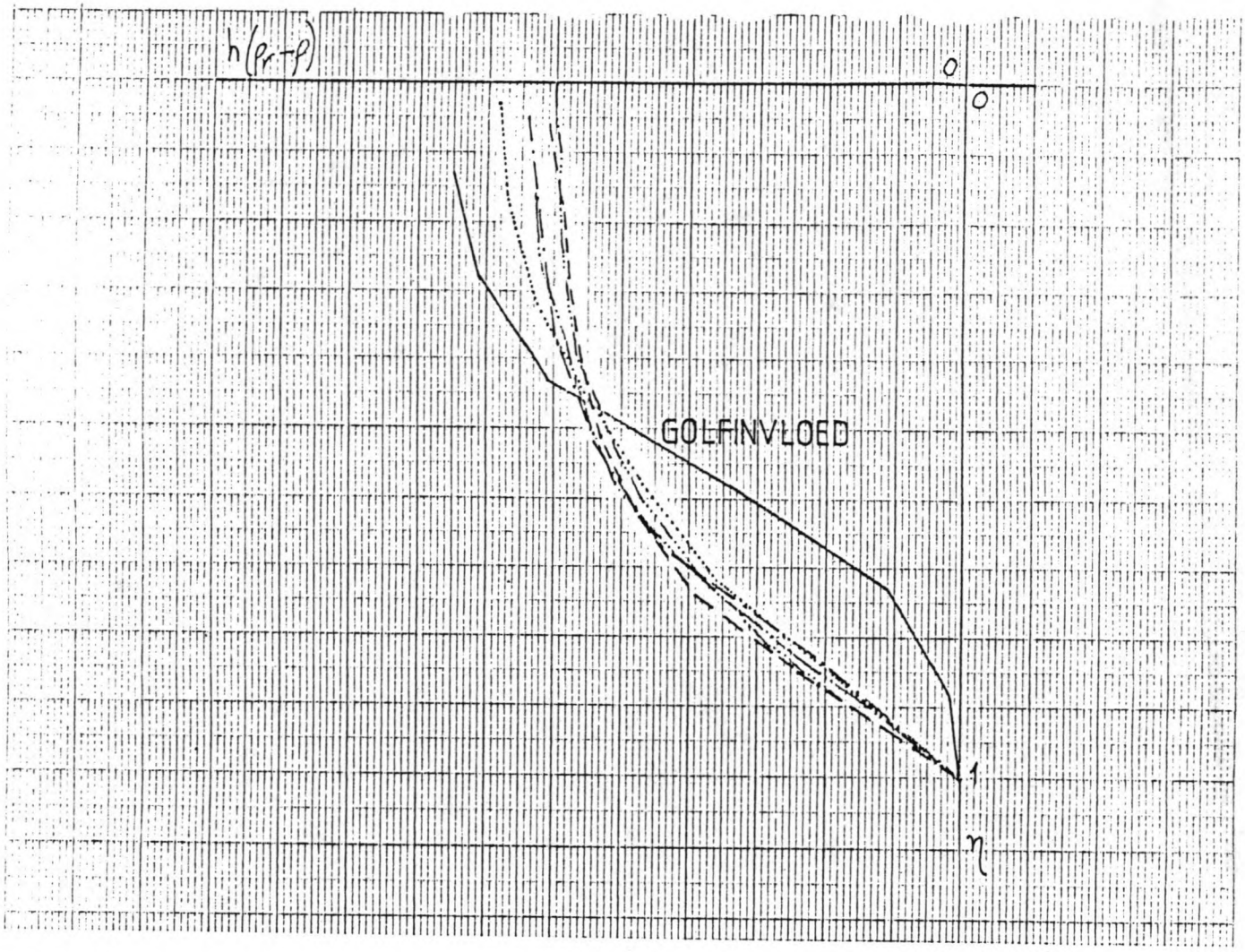

FIG 47

EXP 2 t = 480 SEC

——— METING
- - - - - - - DIFF. MODEL
— · — · — M.W.L.MODEL
..... K1-MODEL
——··—— K2-MODEL
—·····—···· ANAL. OPL..

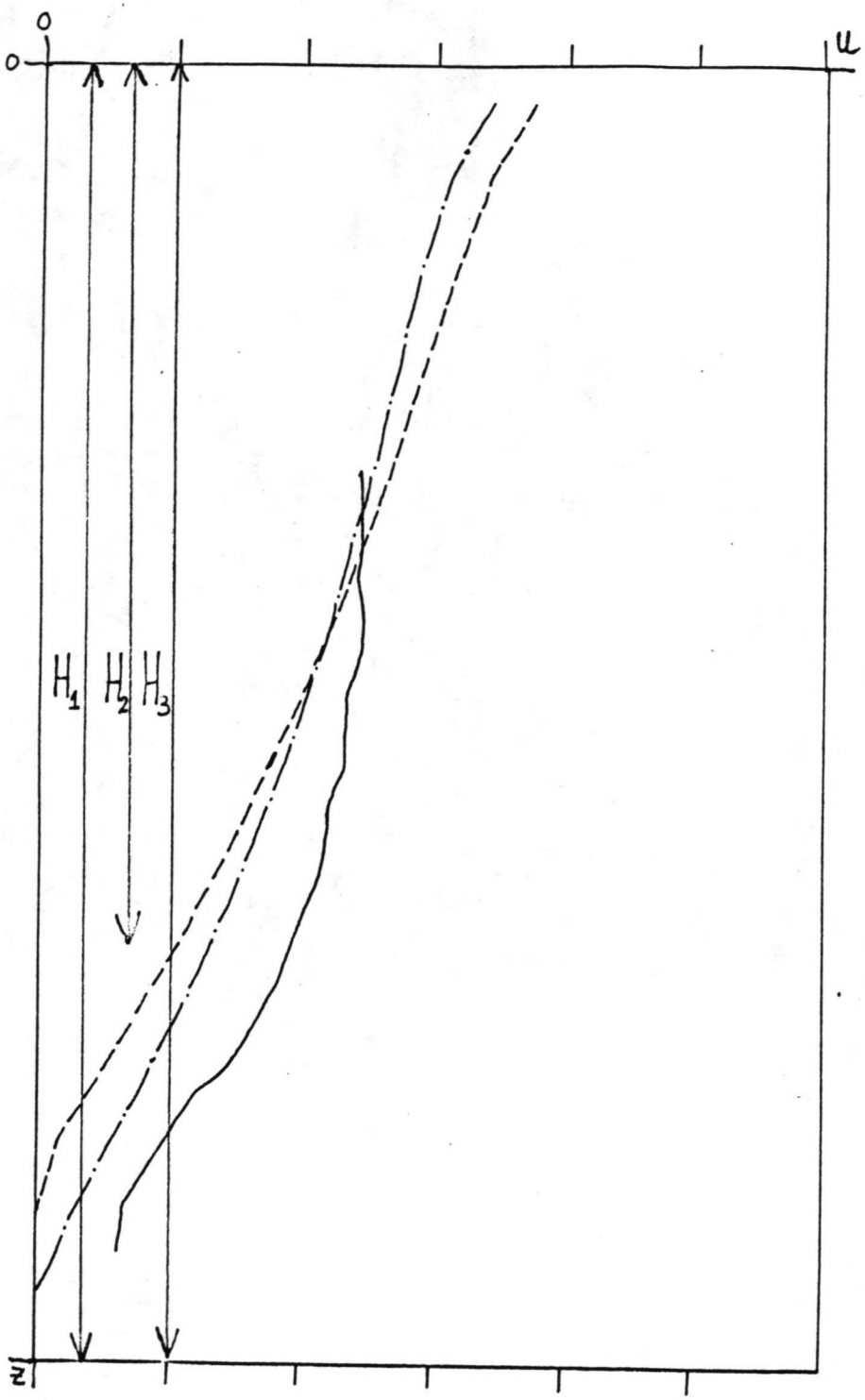

FIG 46

EXP 2 t=880 SEC

——— METING
- - - - - - DIFF. MODEL
—·—·— M.W.L.-EN K2-MODEL

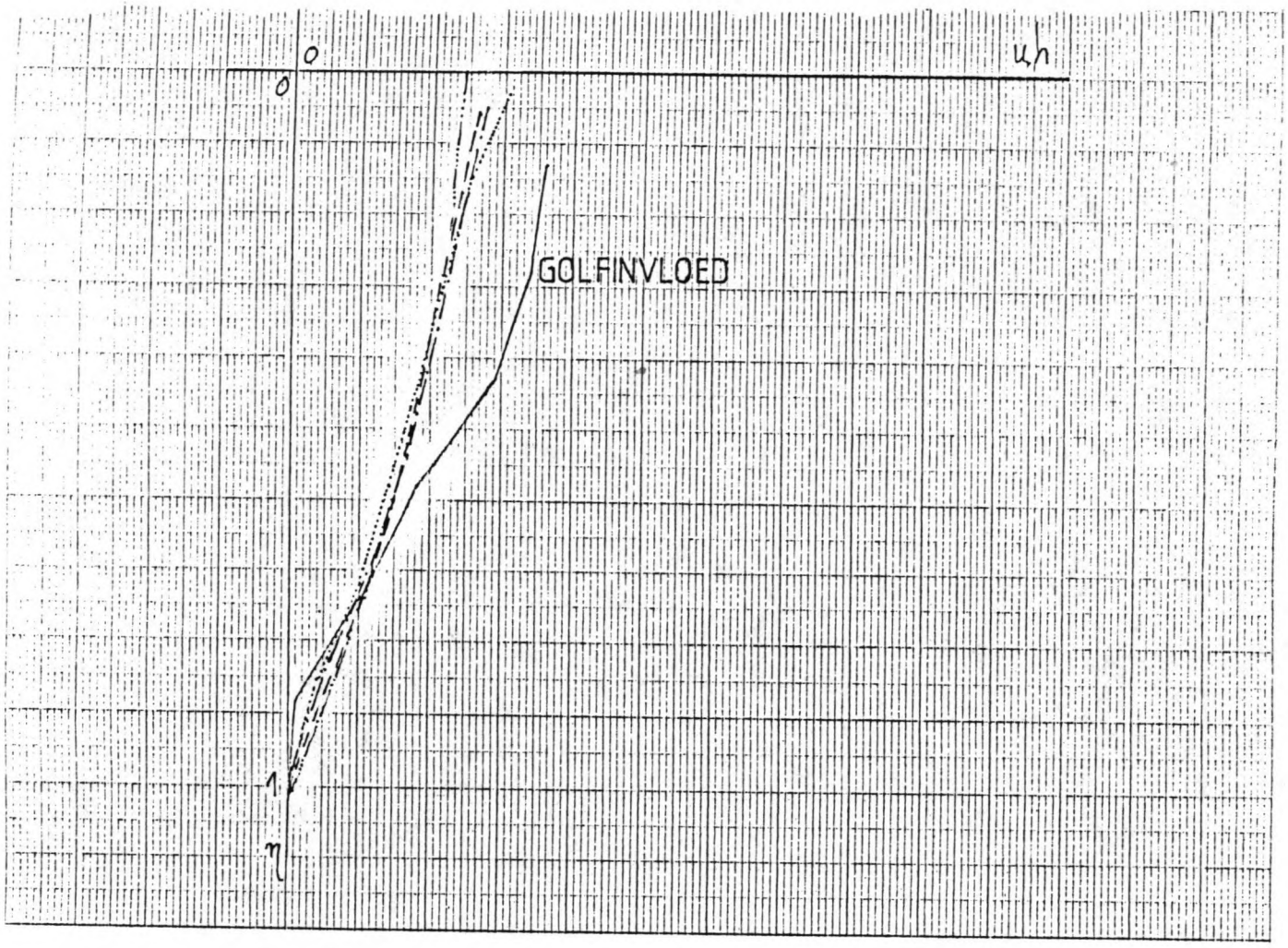

FIG 48

EXP 2 t = 480 SEC

——— METING
- - - - - - DIFF. MODEL
—·—·—· M.W.L-EN K2-MODEL
..... K1-MODEL
—···—···— ANAL. OPL.

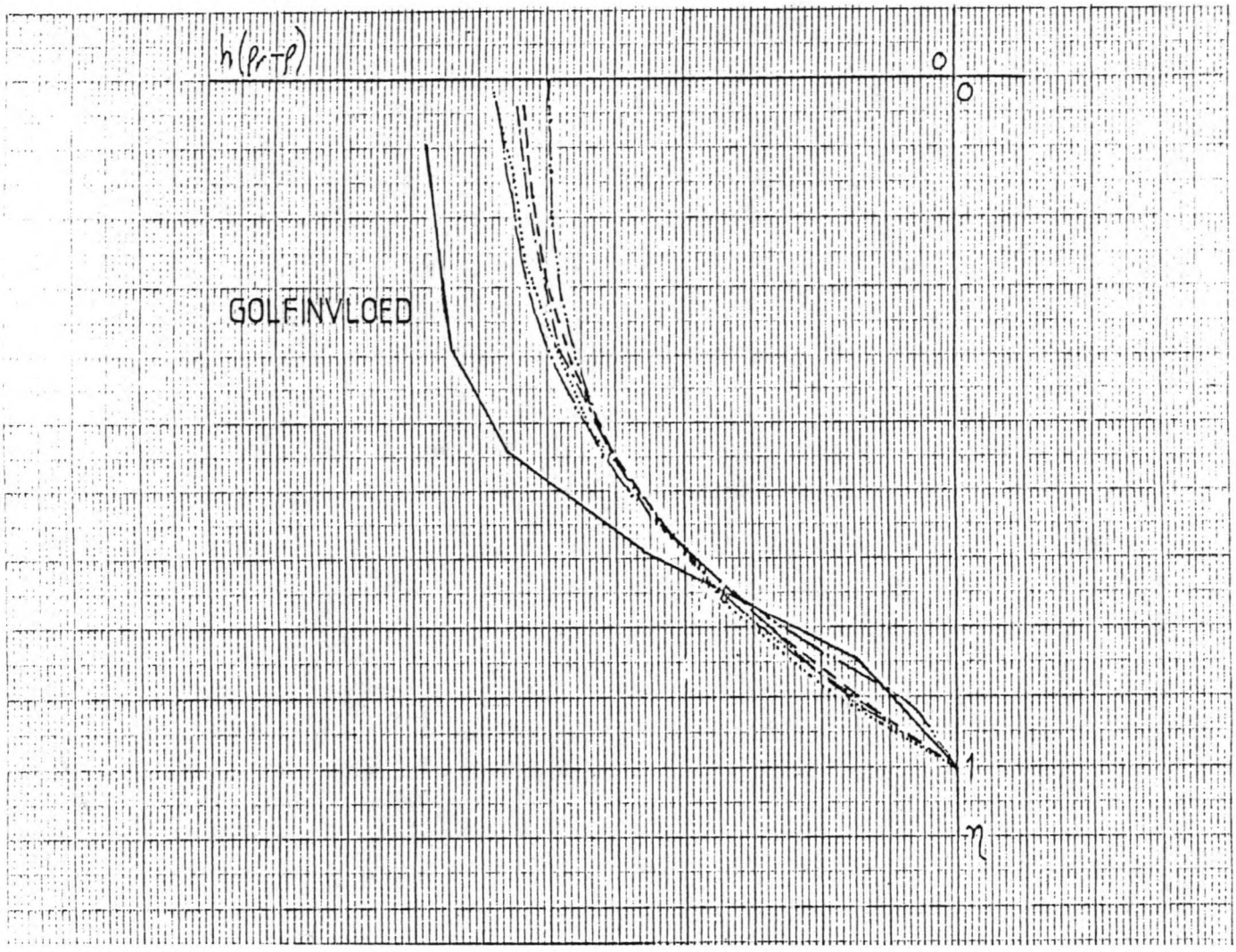

FIG 49

EXP 2 t = 680 SEC

——— METING
- - - - - - - DIFF. MODEL
—·—·—·— M.W.L.MODEL
..... K1-MODEL
——··—— K2-MODEL
—···—···—···— ANAL.OPL..

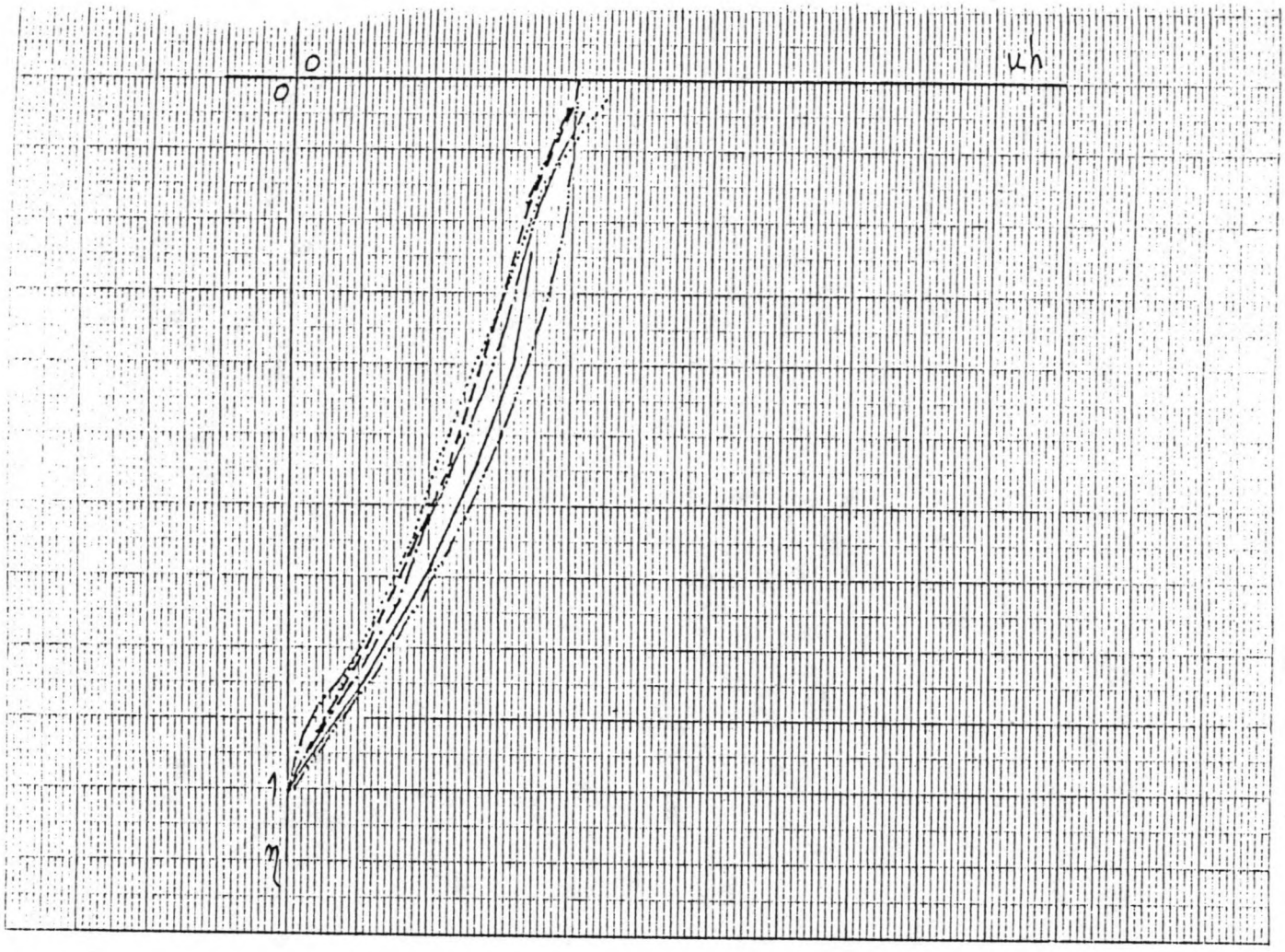

FIG 50

EXP 2 t = 680 SEC

——— METING
- - - - - - - DIFF. MODEL
—·—·—·— M.W.L.MODEL
..... K1-MODEL
——··—— K2-MODEL
—·····—·····— ANAL.OPL..

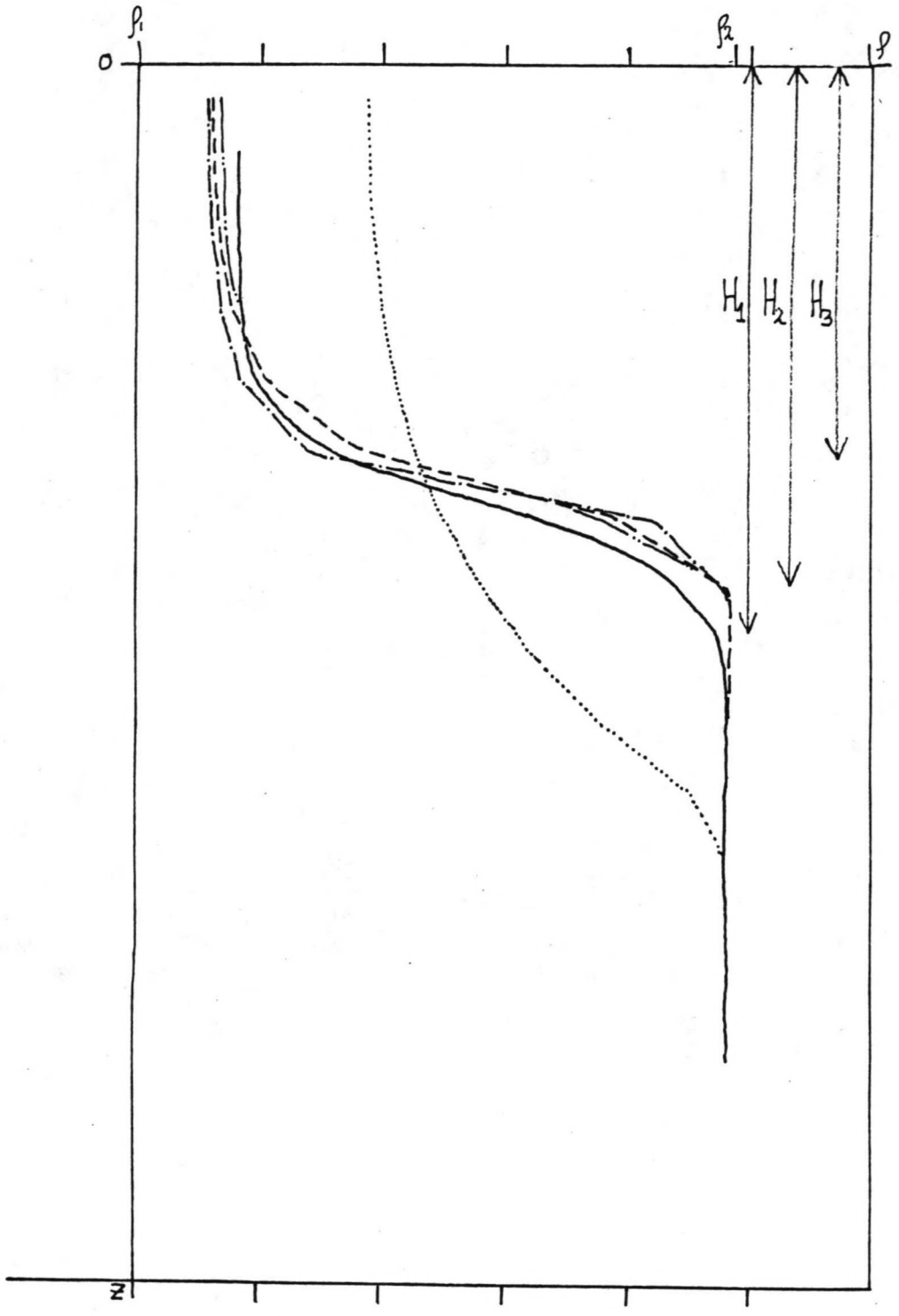

FIG 51

EXP 3 t= 580 SEC

——— METING
- - - - - - - DIFF. MODEL
—·—·—·— M.W.L.MODEL
..... K1-MODEL
——··—— K2-MODEL

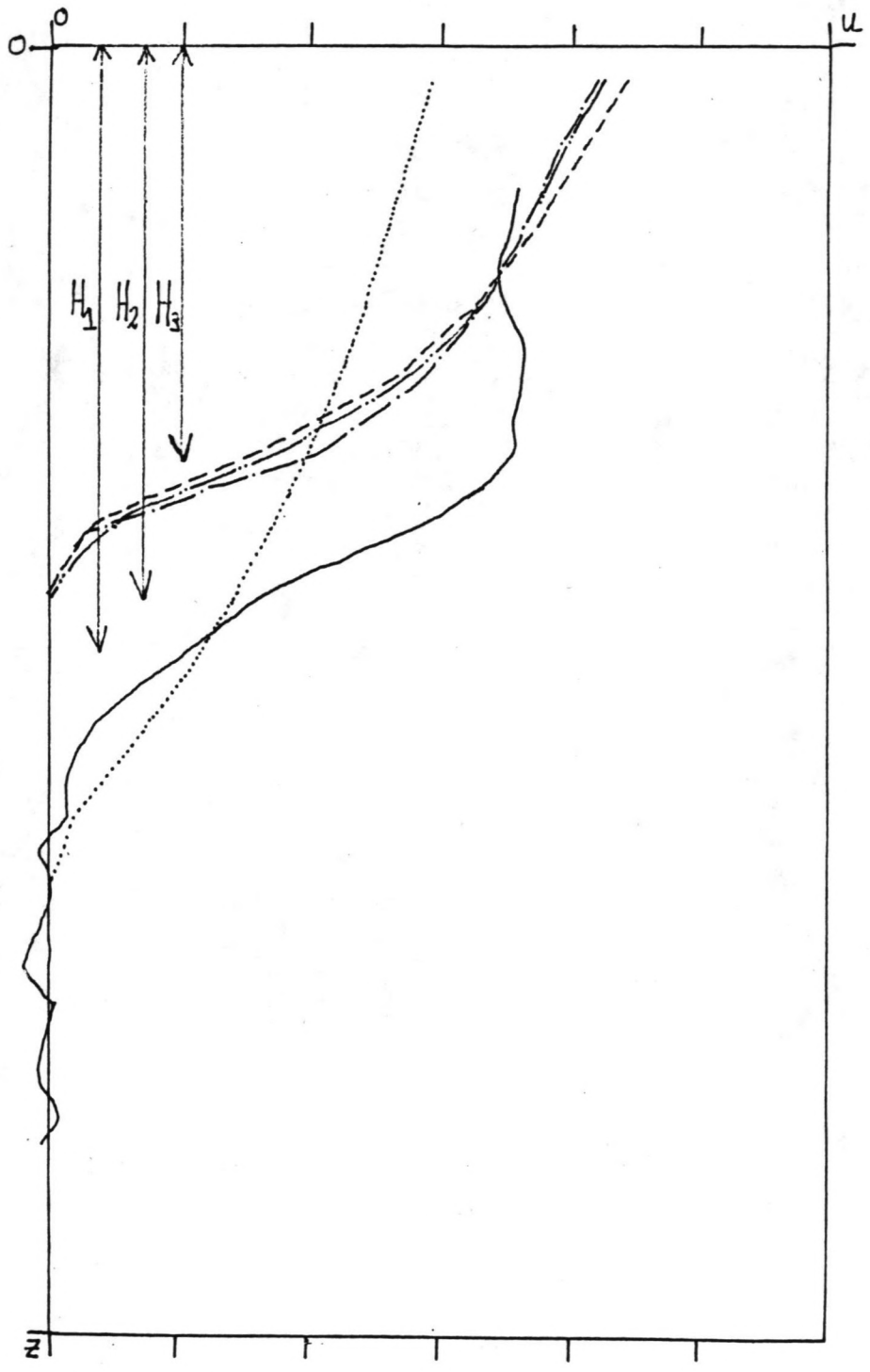

FIG 52

EXP 3 t = 580 SEC

——— METING
- - - - - - - DIFF. MODEL
—·—·—·— M.W.L.MODEL
..... K1-MODEL
——··—— K2-MODEL

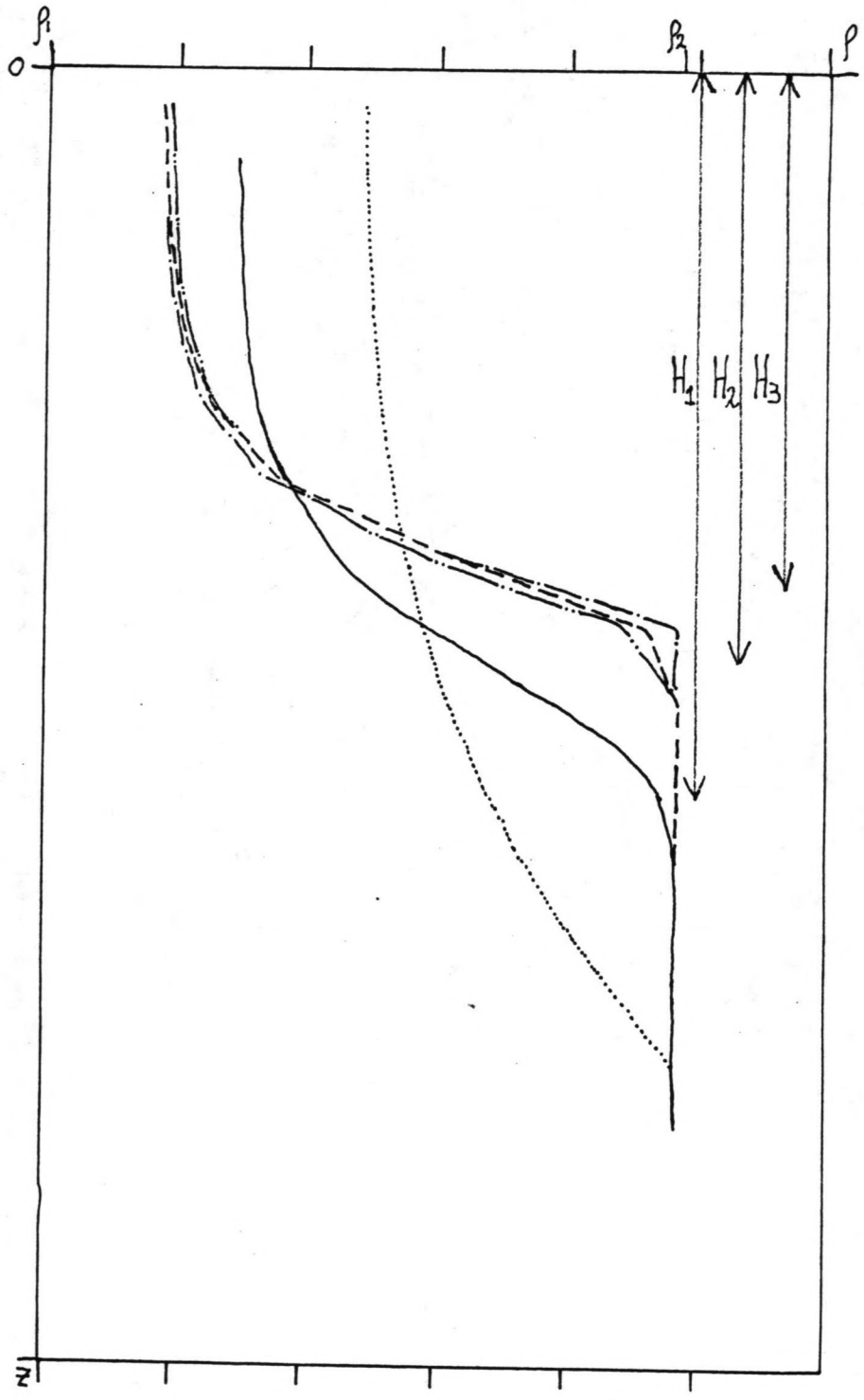

FIG 53

EXP 3 t=720 SEC

——— METING
- - - - - - - DIFF. MODEL
—·—·—·— M.W.L.MODEL
..... K1-MODEL
——··—— K2-MODEL

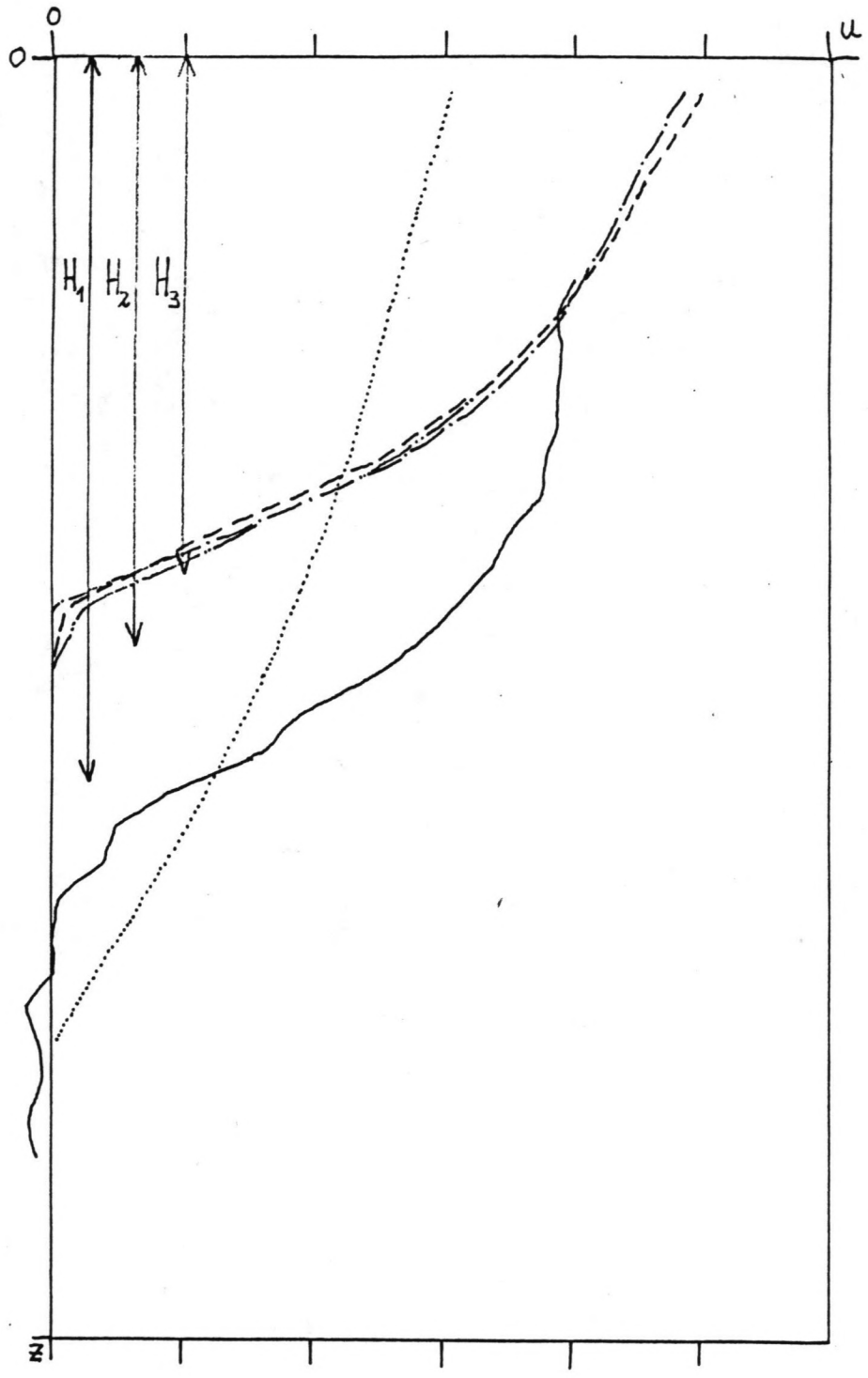

FIG 54

EXP 3 t=720 SEC

——— METING
- - - - - - - DIFF. MODEL
—·—·—·— M.W.L.MODEL
..... K1-MODEL
——··—— K2-MODEL

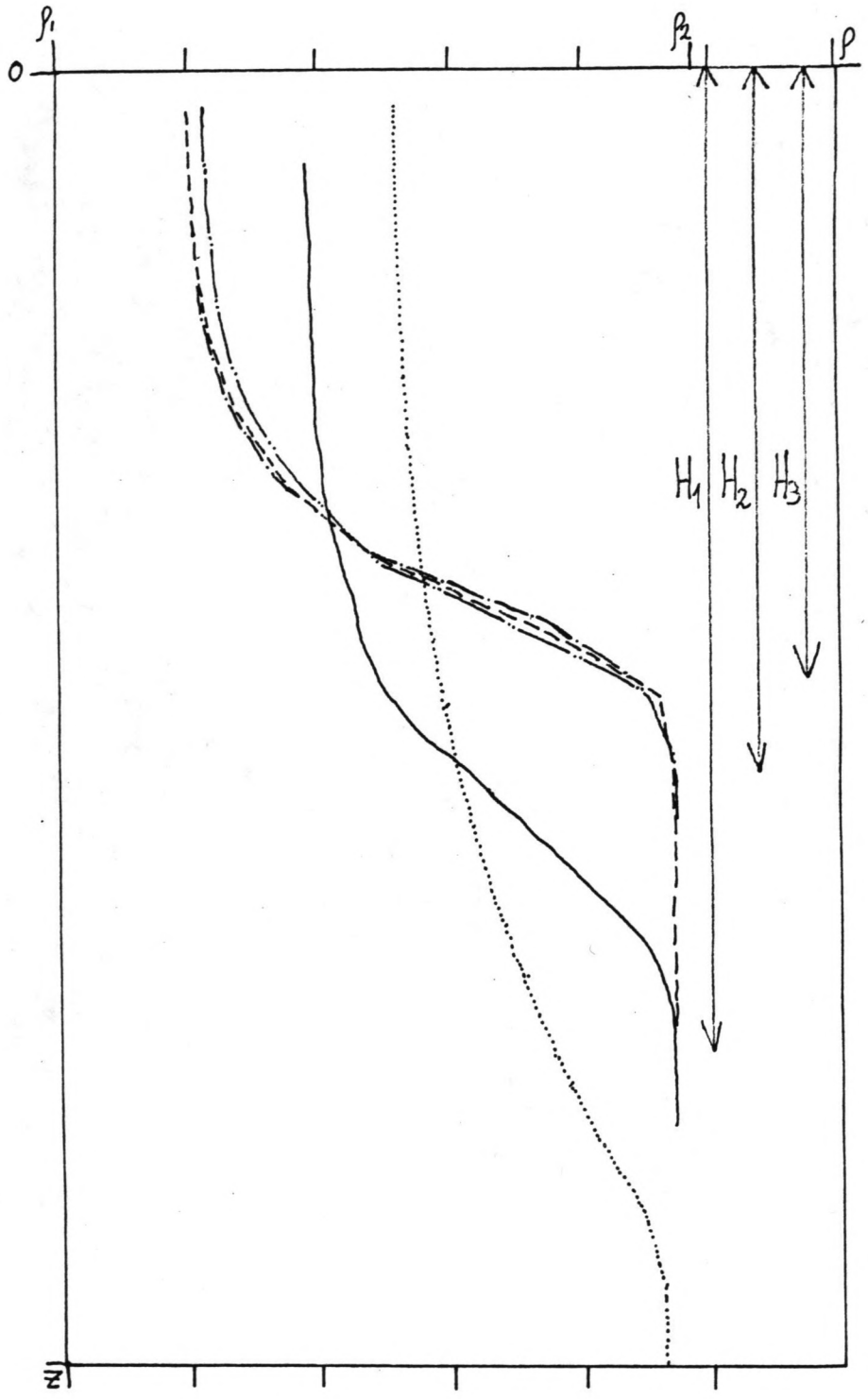

FIG 55

EXP 3 t=860 SEC

METING
DIFF. MODEL
M.W.L.MODEL
K1-MODEL
K2-MODEL

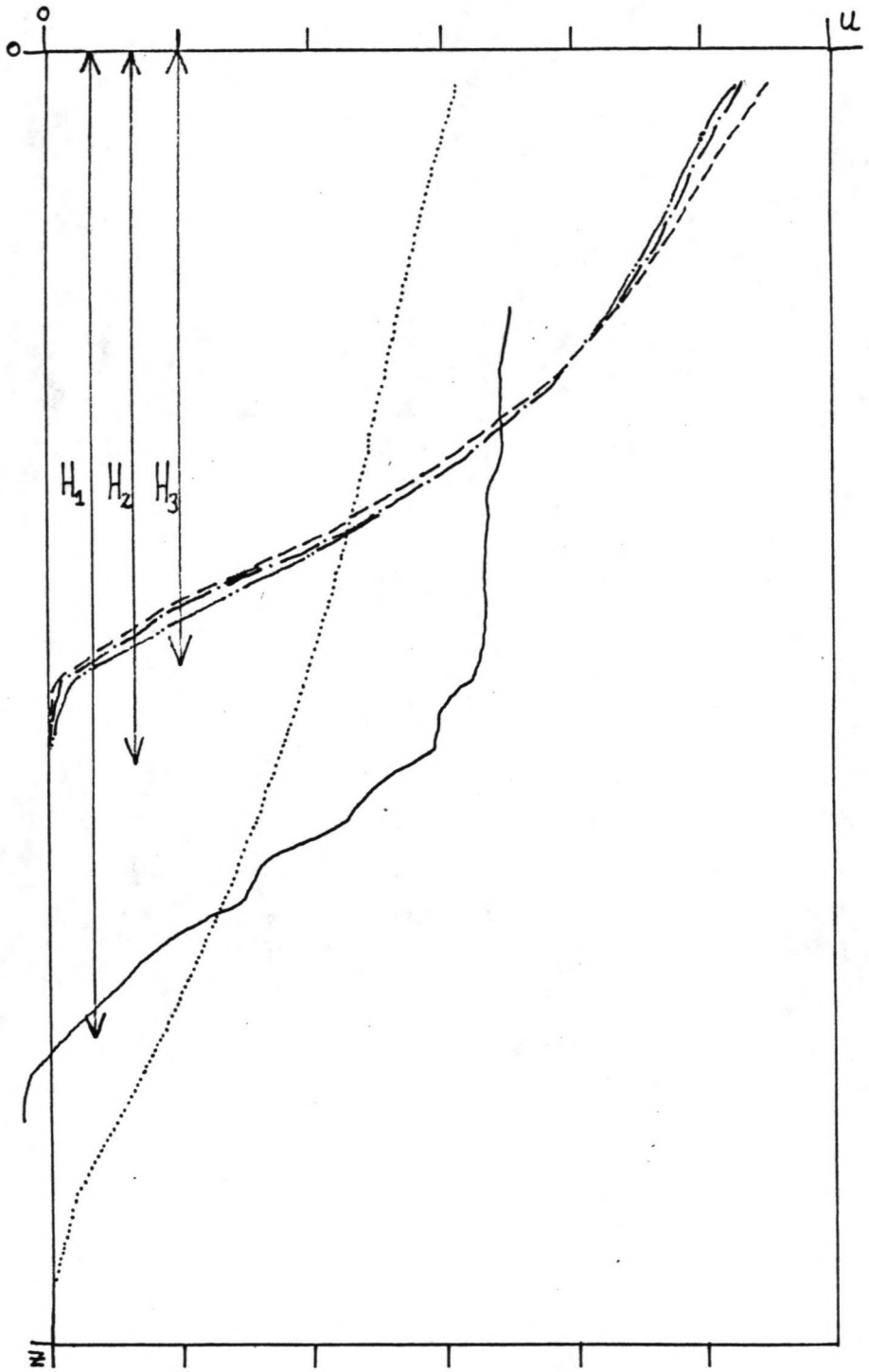

FIG 56

EXP 3 t=860 SEC

METING
DIFF. MODEL
M.W.L.MODEL
K1-MODEL
K2-MODEL

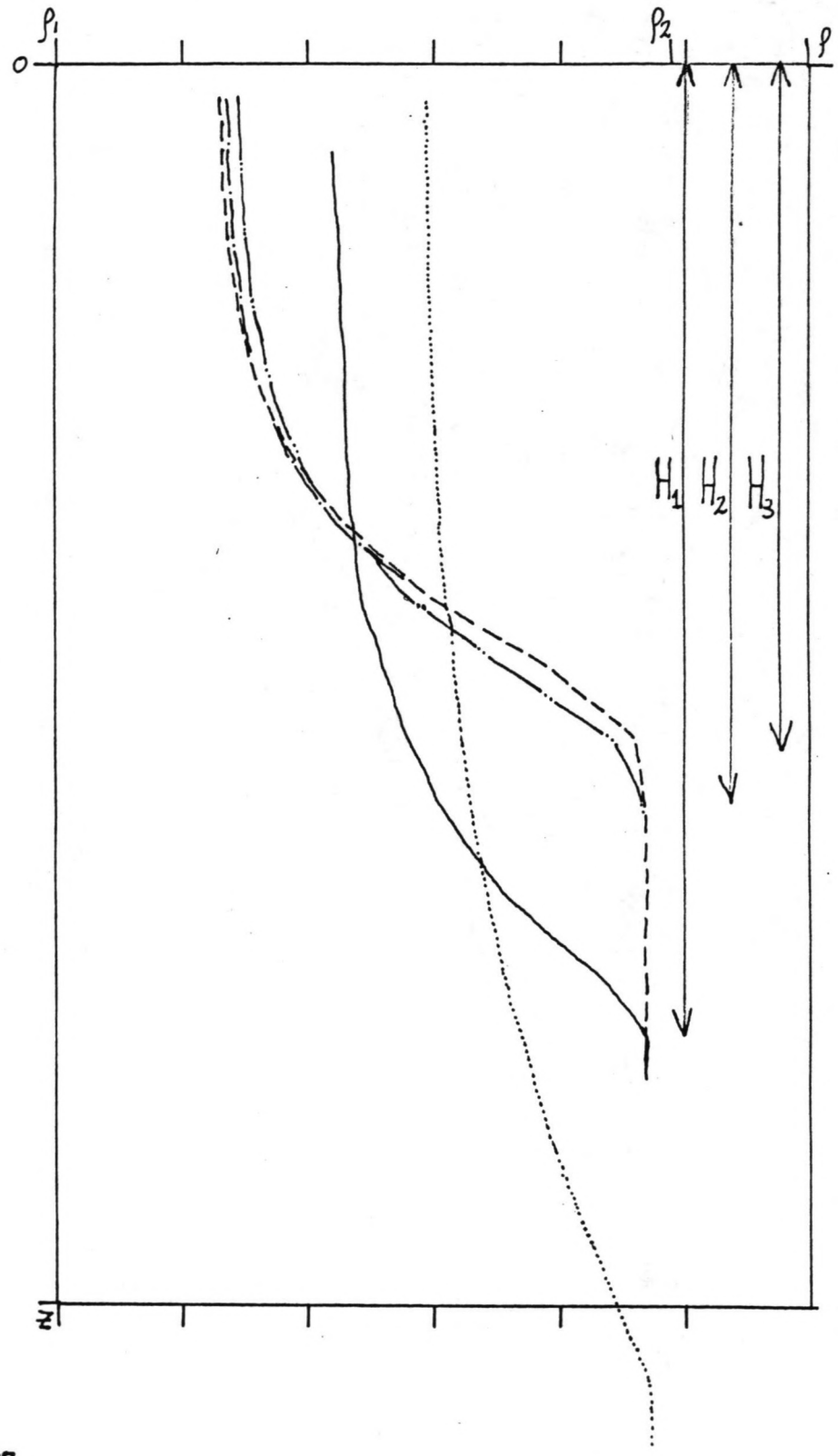

FIG 57

EXP 3 t=1000 SEC

———	METING
- - - - - - -	DIFF. MODEL
—·—·—·—	M.W.L.MODEL
.....	K1-MODEL
——··——	K2-MODEL

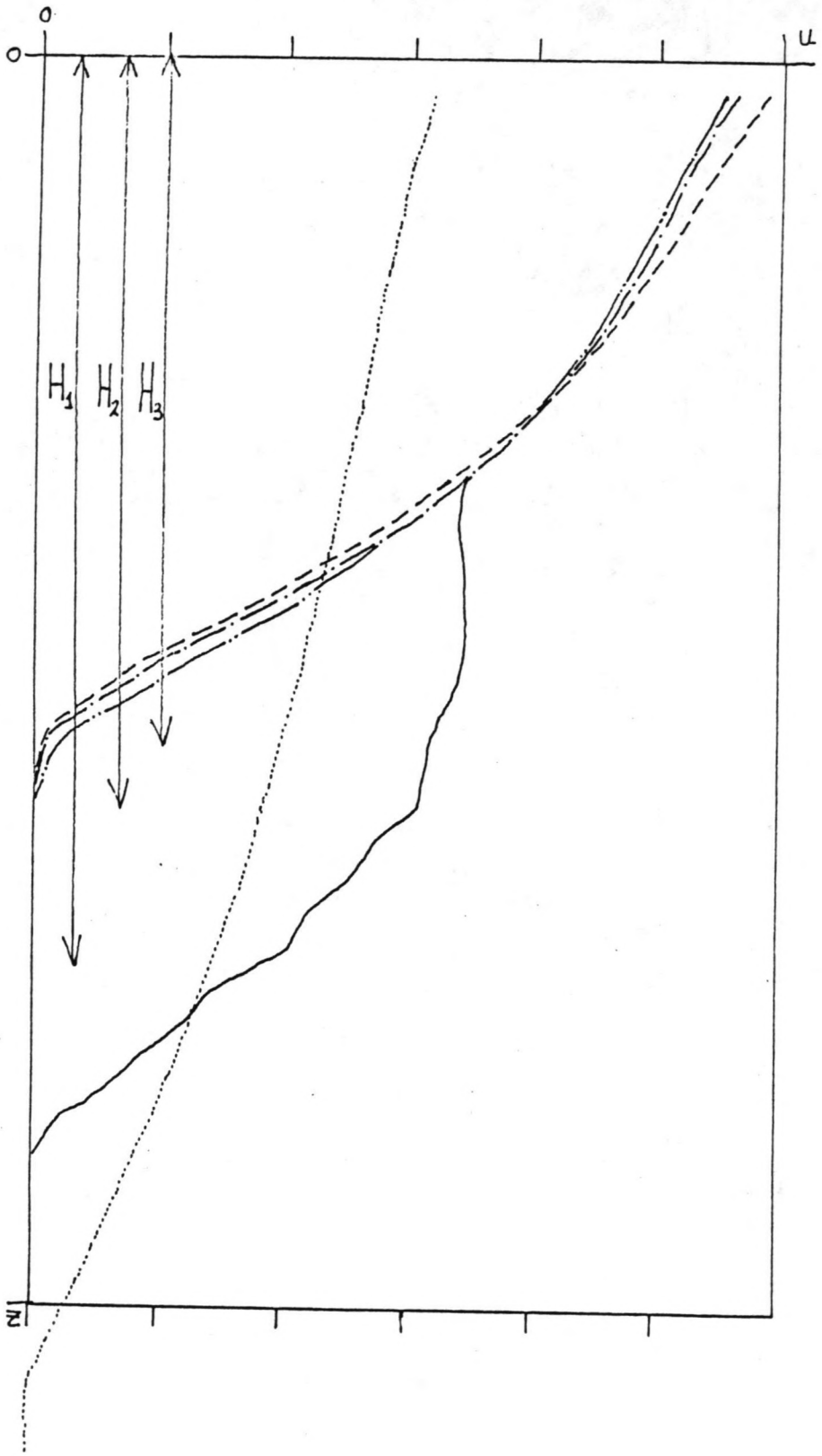

FIG 58

EXP 3 t=1000 SEC

METING
DIFF. MODEL
M.W.L.MODEL
K1-MODEL
K2-MODEL

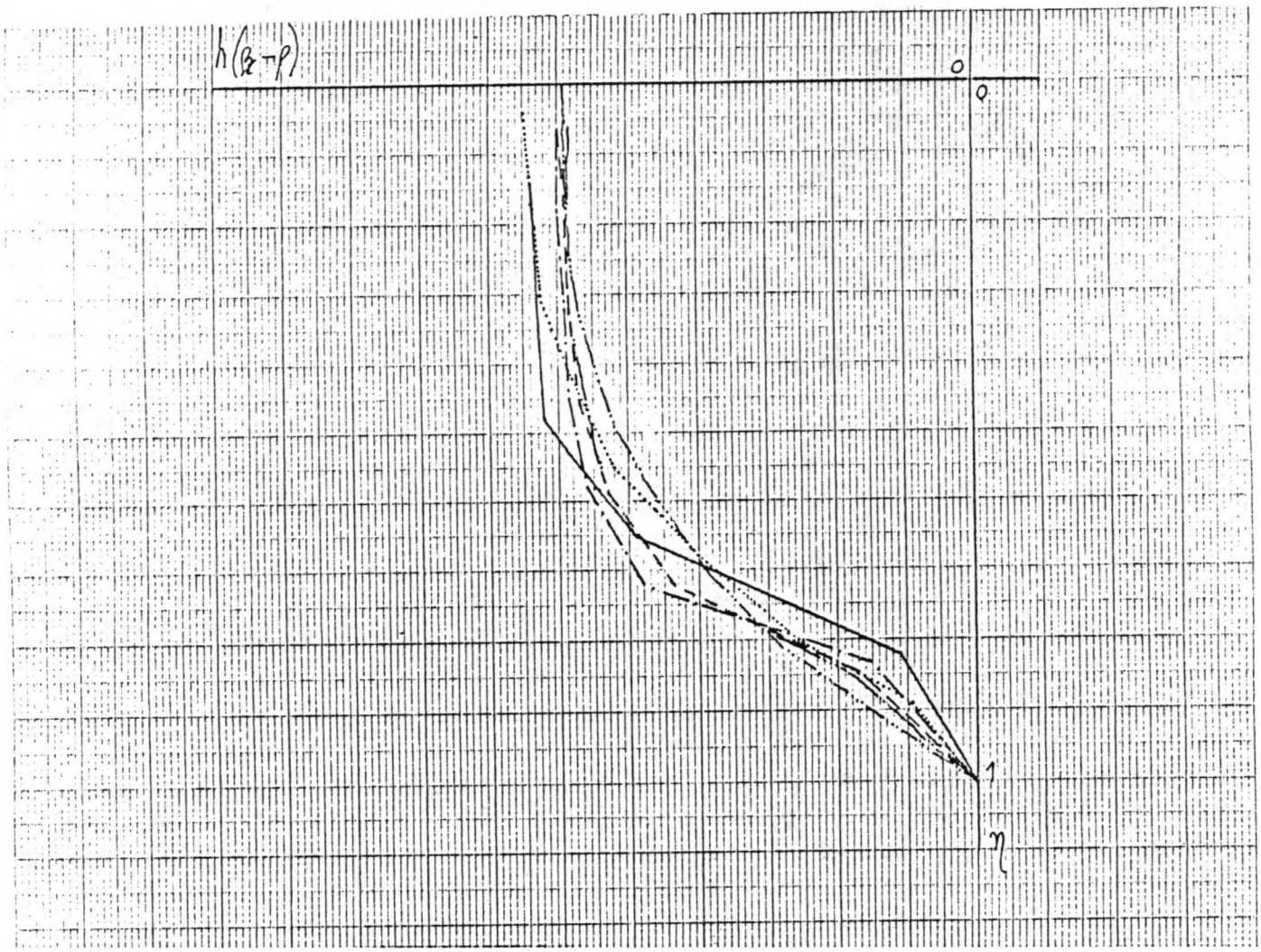

FIG 59

EXP 3 t= 580 SEC

———	METING
- - - - - - -	DIFF. MODEL
—·—·—·—	M.W.L.MODEL
.....	K1-MODEL
——··——	K2-MODEL
—·····—·····—	ANAL.OPL..

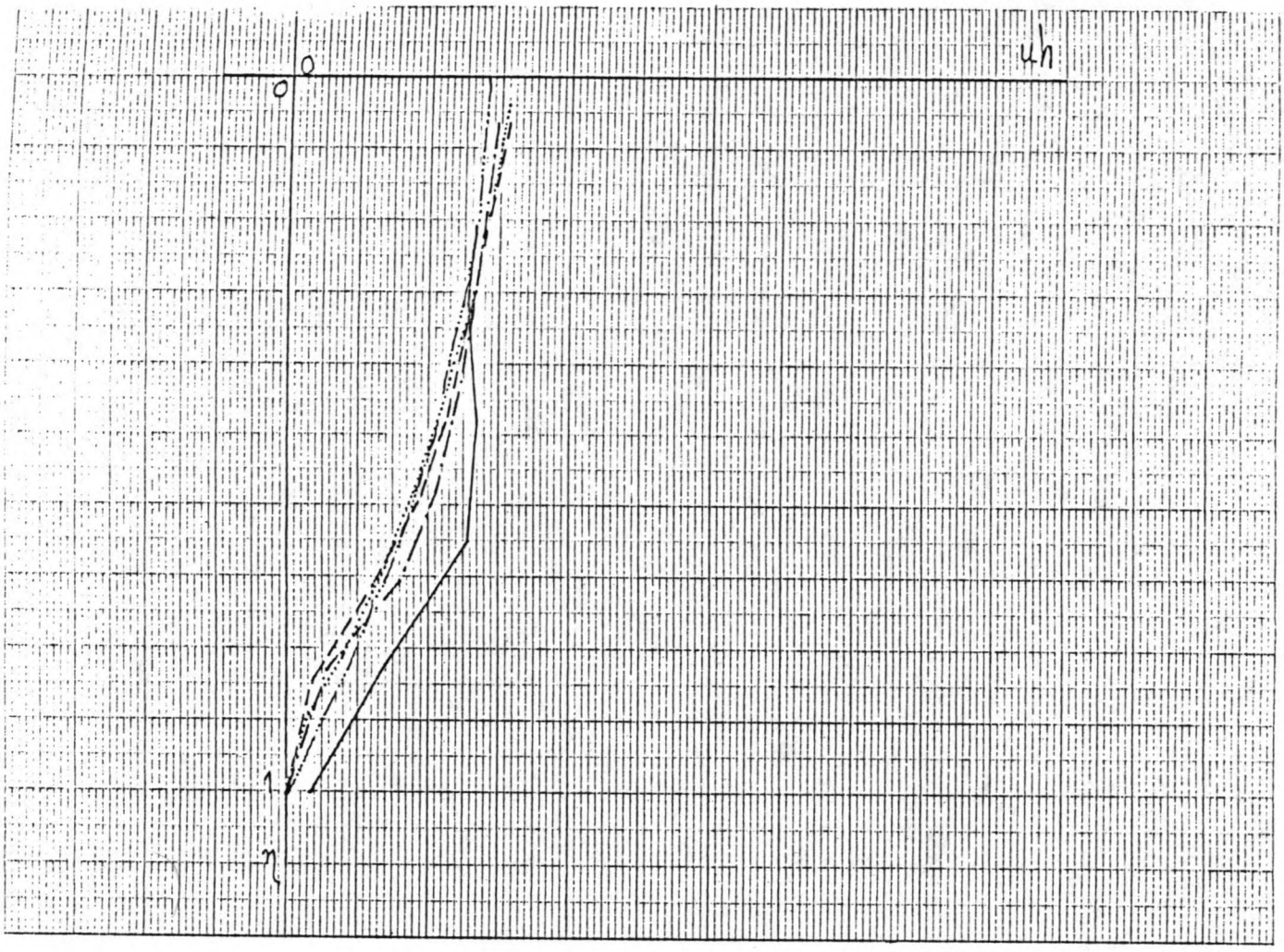

FIG 60

EXP 3 t = 580 SEC

——— METING
- - - - - - DIFF. MODEL
— · — · — · M.W.L.-EN K2-MODEL
..... K1-MODEL
— ··· — ··· — ··· ANAL. OPL.

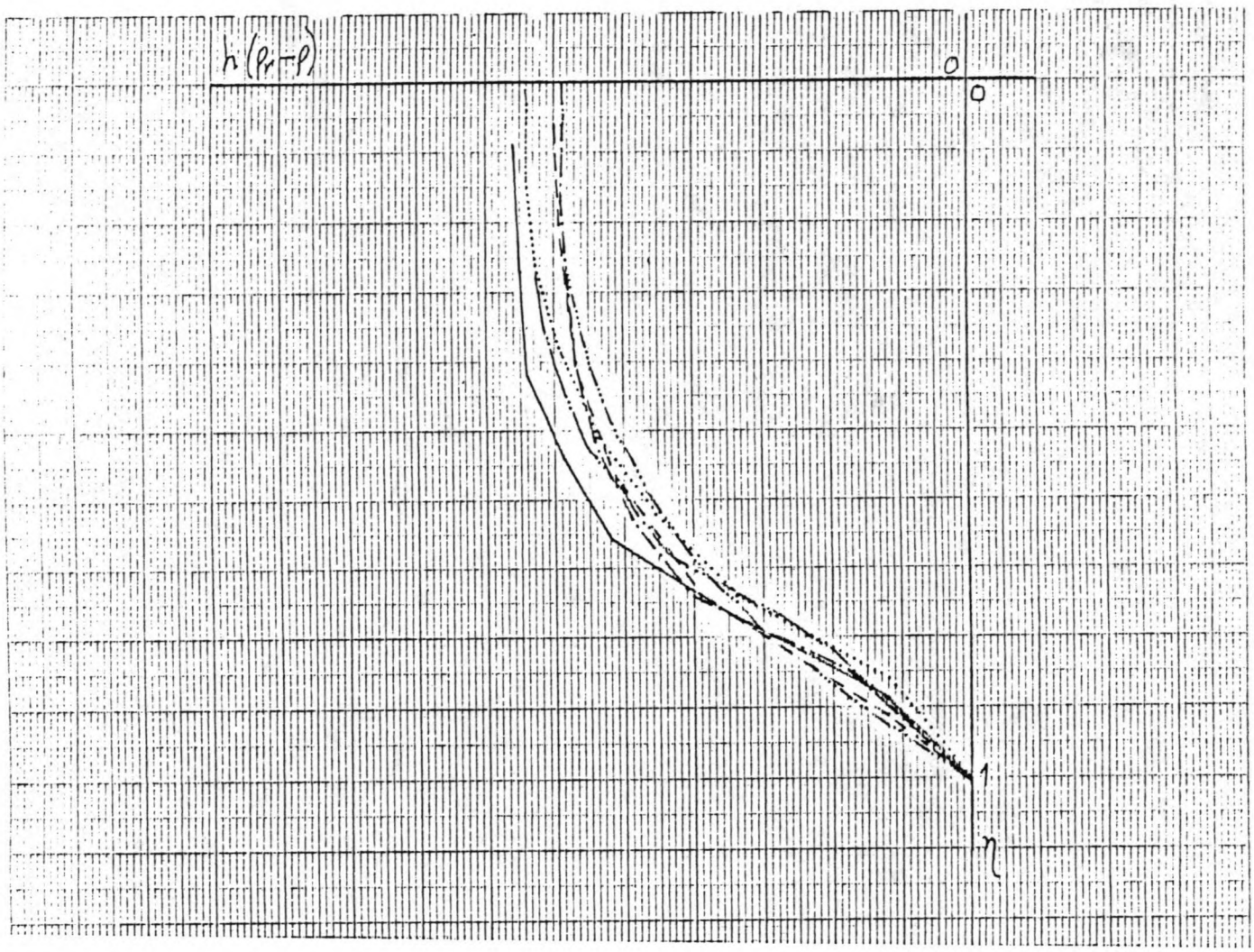

FIG 61

EXP 3 t = 860 SEC

——— METING
- - - - - - - DIFF. MODEL
—·—·—·— M.W.L.MODEL
..... K1-MODEL
——··—— K2-MODEL
—···—···—··· ANAL.OPL..

FIG 62

EXP 3 t=860 SEC

——— METING
- - - - - - - DIFF. MODEL
—·—·—·— M.W.L.MODEL
..... K1-MODEL
——··—— K2-MODEL
—···—···—··· ANAL.OPL..

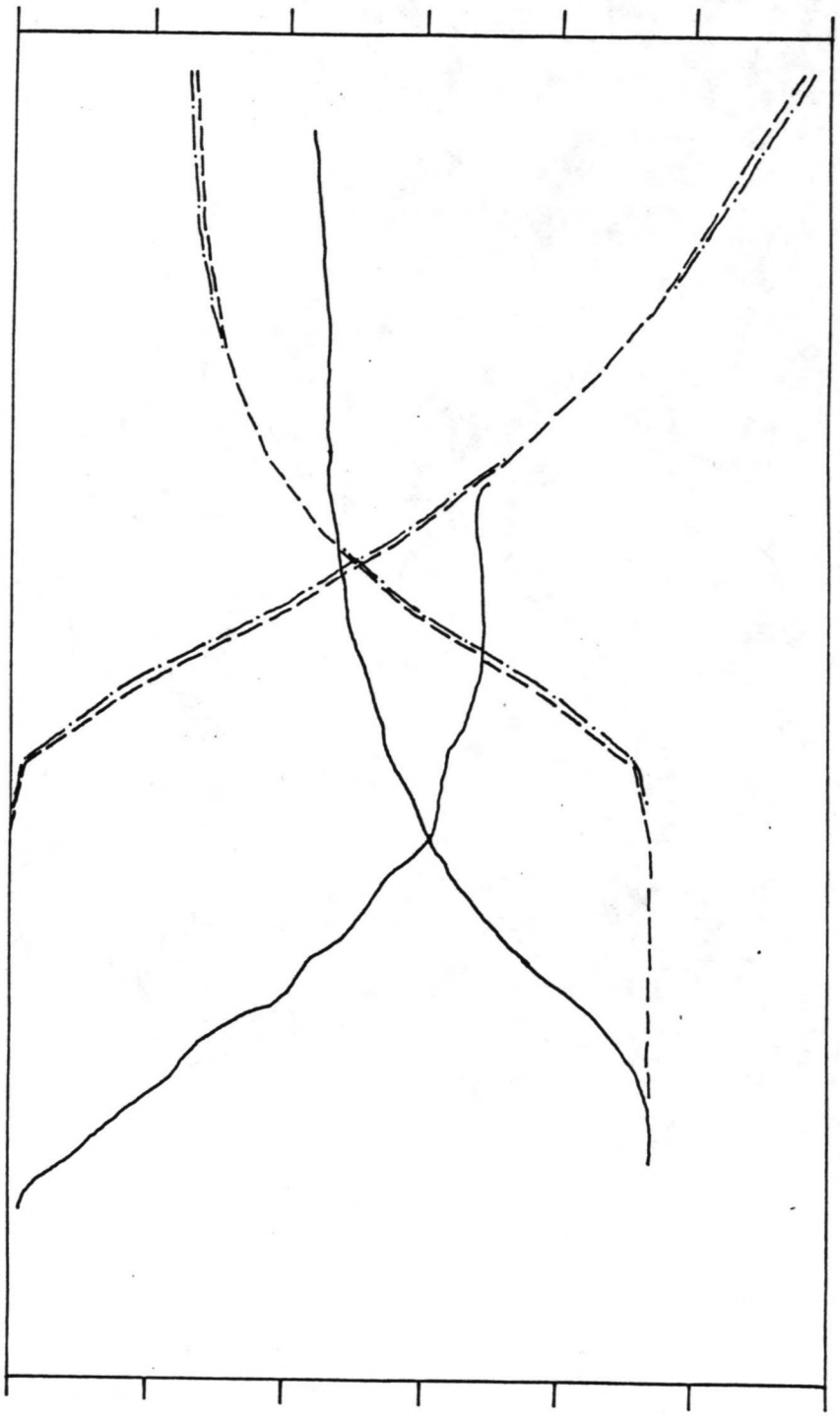

FIG 63

EXP 3 $t = 1000$ SEC.

——— METING

—·— OORSPRONKELIJK MODEL

– – – ALTERNATIEF MODEL

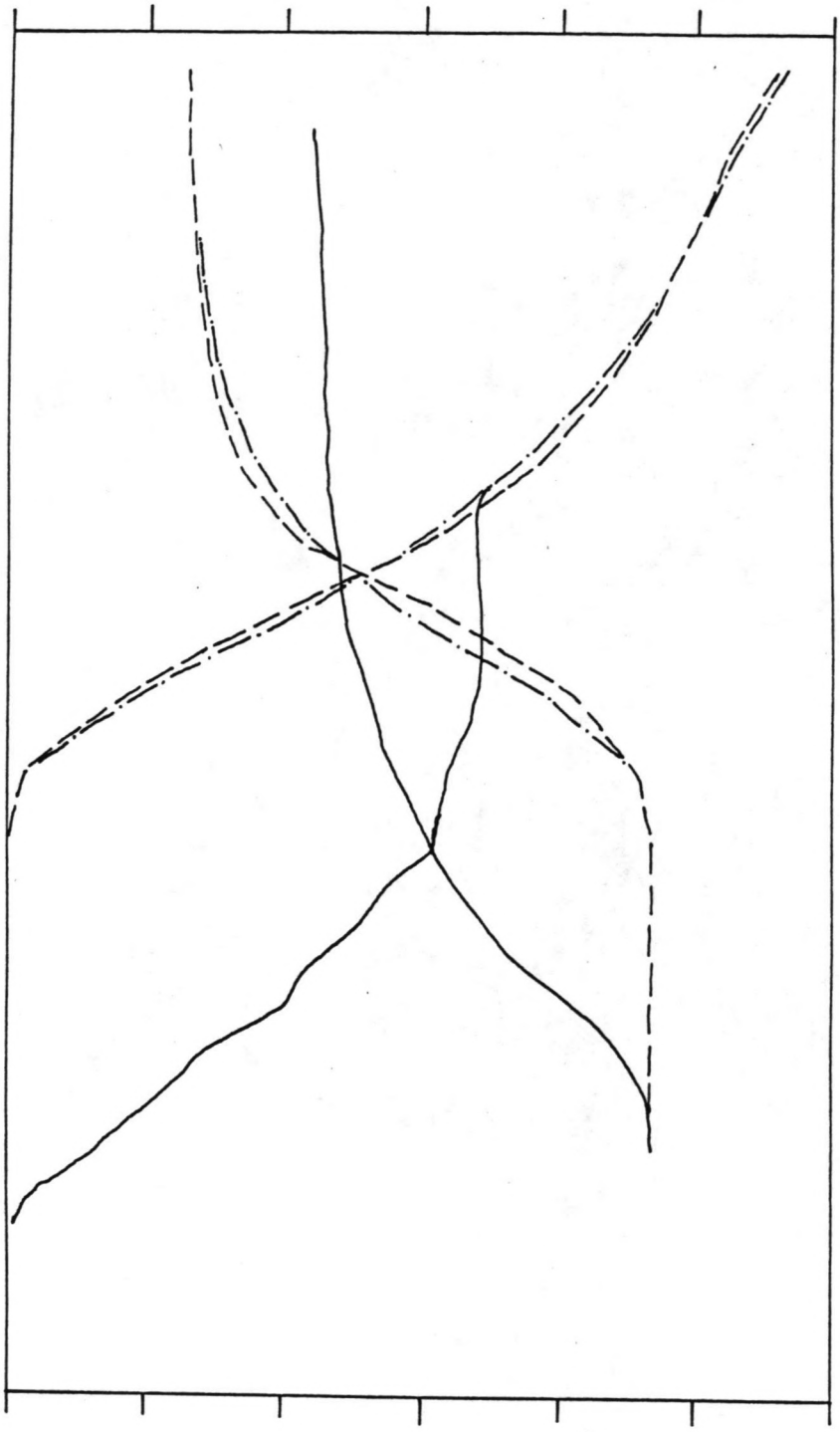

FIG 64

EXP 3 t = 1000 SEC.

——— METING

—·— OORSPRONKELIJK MODEL

— — — ALTERNATIEF MODEL

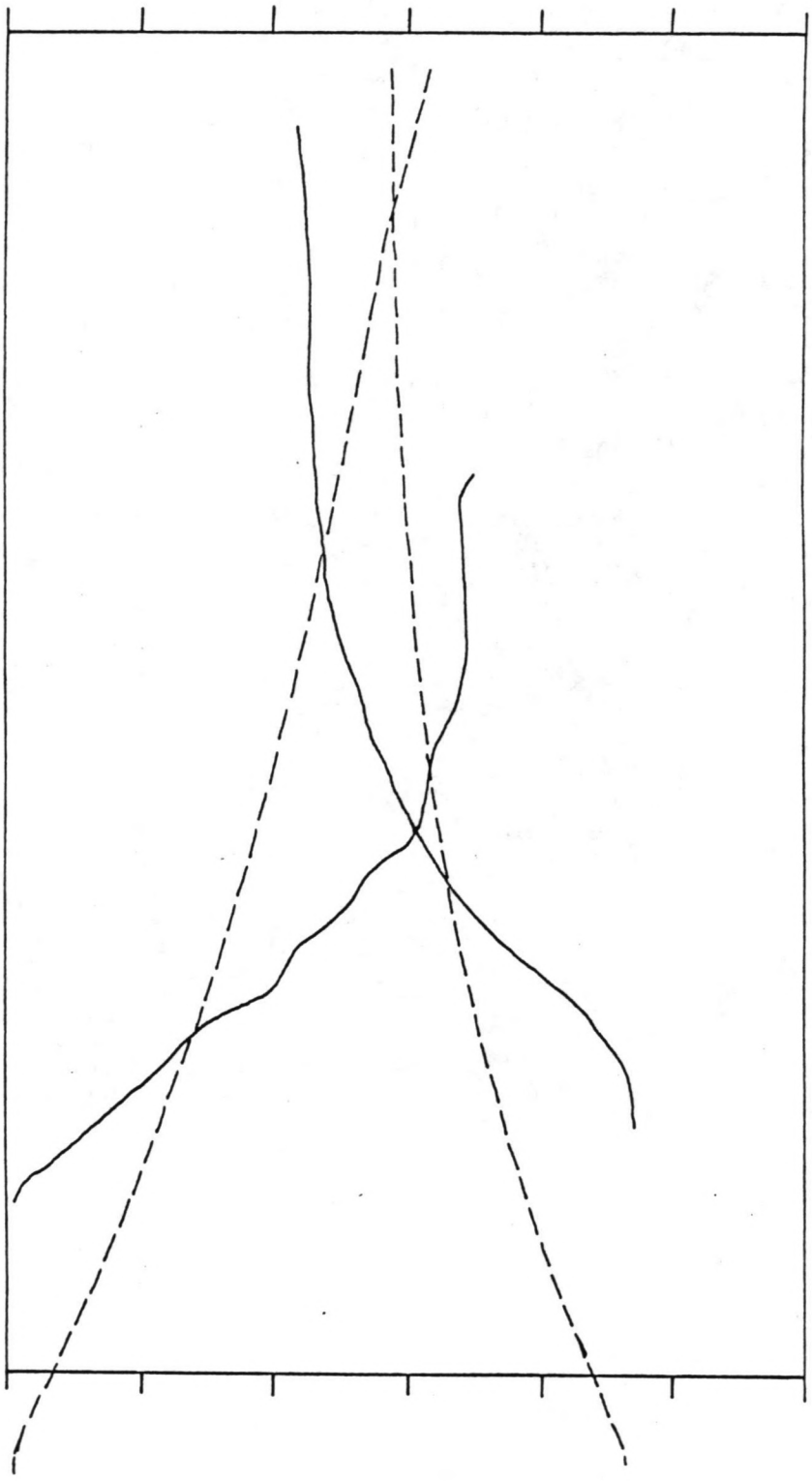

FIG 65

——— METING

– – – OORSPRONKELIJK EN ALTERNATIEF MODEL

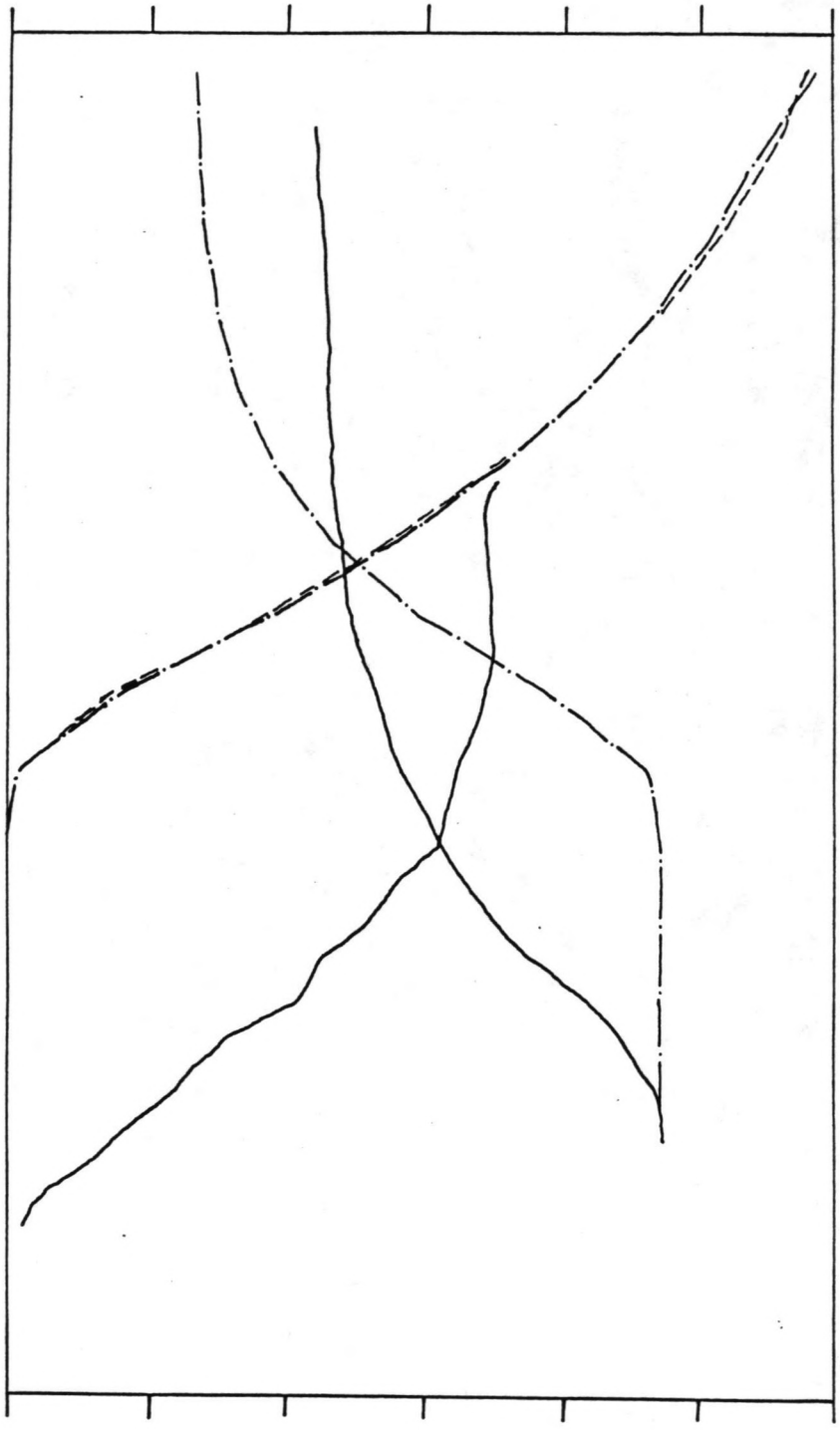

FIG 66

EXP 3 $t = 1000$ SEC.

——— METING

—·— OORSPRONKELIJK MODEL

—·— ALTERNATIEF MODEL

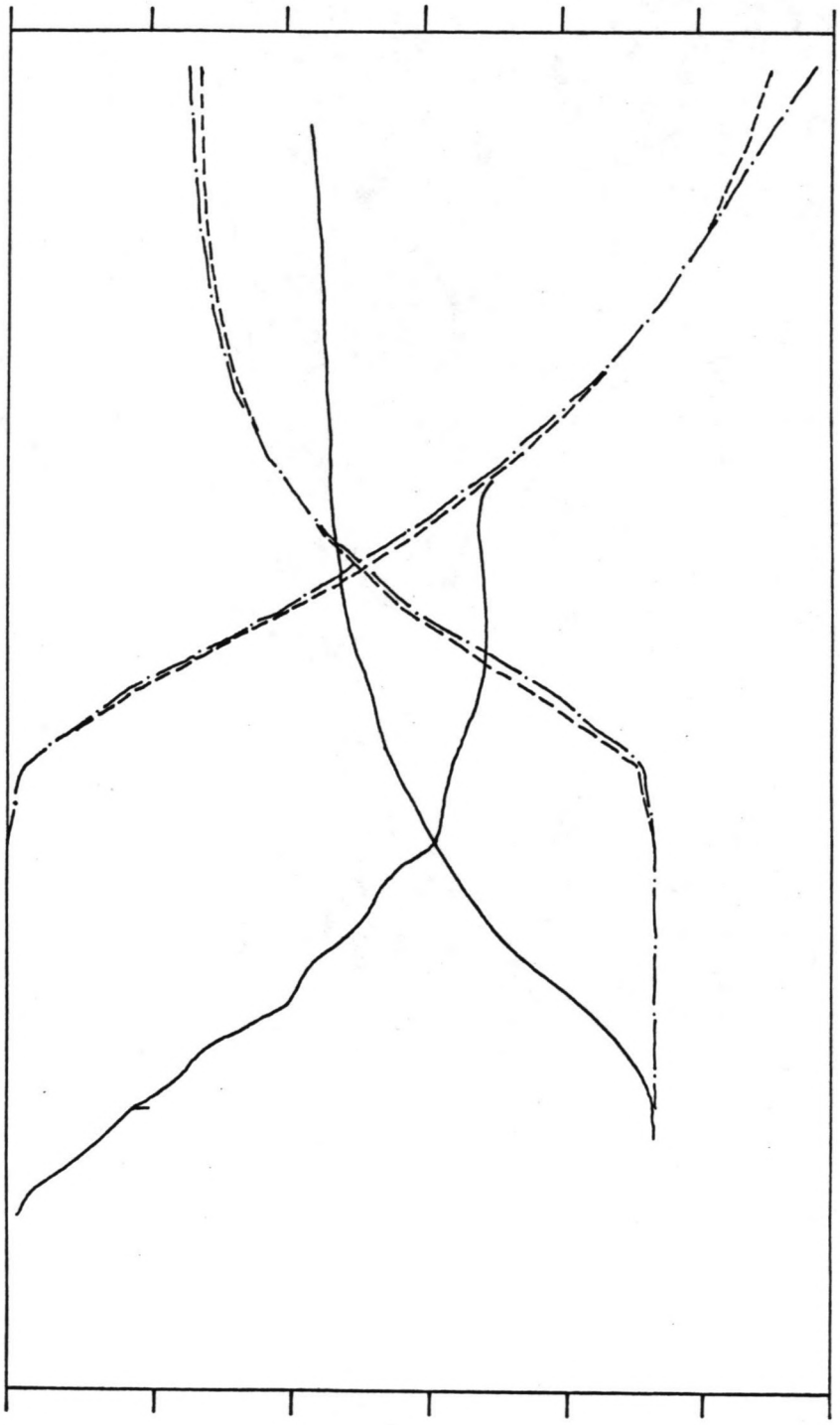

FIG 67

EXP 3 t = 1000 SEC.

——— METING

—·— OORSPRONKELIJK MODEL

—·— ALTERNATIEF MODEL

Komputerprogramma

```
      PROGRAM JOPID                                                     10
C     ************                                                      20
C                                                                       30
C     DELFT HYDRAULICS LABORATORY DEPARTMENT WILD                       40
C                                                                       50
C     JOPID.01          AUGUSTUS 01 1984       K.JOPPE                60
C                                                                       70
C     FUNKTIE         : EEN-DIMENSIONALE BEREKENING VAN WINDTURBULENTIE  80
C                       EN MENGING IN EEN GELAAGD MEER                  90
C     ENTRY           : PROGRAM ACTIVATION                             100
C     EXIT            : PROGRAM TERMINATION                            110
C     ERROR MESSAGES  : NONE                                           120
C     LOGICAL UNITS   : LUN  5 = INPUT DATA FILE                       130
C                     : LUN  6 = PRINT DEVICE                          140
C     SUBROUTINES     : CHARACTER FUNCTION TIME()                      150
C                     : CHARACTER FUNCTION DATE()                      160
C                               BOTH ARE MACHINE (CDC CYBER 170        170
C                               SERIES) DEPENDENT ROUTINES             180
C                     : BANNER                                         190
C                     : REQCMM - SYSTEM ROUTINE DYNAMIC CORE           200
C                     :          ALLOCATION                            210
C                     : DICHT                                          220
C                     : DEMP                                           230
C                     : DIFFUS                                         240
C                     : MAPOUT                                         250
C                     : PRIHIS                                         260
C                     : PLOTOV                                         270
C                     : PLOTHI                                         280
C                     : PLOTTU                                         290
C                                                                      300
C     **********                                                       310
C     PARAMETERS                                                       320
C     **********                                                       330
C                                                                      340
C     NAME      TYPE      LENGTH   DESCRIPTION                        350
C     ----      ----      ------   -----------                        360
C                                                                      370
C     ALF       R         1        KONSTANTE MUNK-ANDERSON            380
C     ALFA      R         1        KORREKTOR VOOR TURBULENTE DIEPTE   390
C     AMA       R         1        DIFF.KOEFF. IMPULSIE 'BOVEN' LAAG  400
C     AMB       R         1        DIFF.KOEFF. IMPULSIE 'ONDER' LAAG  410
C     ARA       R         1        DIFF.KOEFF. DICHTHEID 'ONDER' LAAG 420
C     ARB       R         1        DIFF.KOEFF. DICHTHEID 'BOVEN' LAAG 430
C     BET       R         1        KONSTANTE MUNK-ANDERSON            440
C     CD        R         1        KONSTANTE MAMAYEV                  450
C     CKA       R         1        KONSTANTE DIFF.KOEFF. IMPULSIE     460
C     CKAR      R         R        KONSTANTE VAN VON KARMAN           470
C     CKB       R         1        KONSTANTE DIFF.KOEFF. DICHTHEID    480
C     CM        R         1        KONSTANTE MAMAYEV                  490
C     DEL       R         1        KONSTANTE MUNK-ANDERSON            500
C     DMOL      R         1        MOLEKULAIRE DIFFUSIEKOEFFICIENT    510
C     DRA       R         1        D.H.VERSCHIL 2 LAGEN BIJ LIN. DHV  520
C     DT        R         1        TIJDSTAP                           530
C     DTHIS     R         1        INTERVAL HISTORYRESULTATEN         540
C     DTMAP     R         1        INTERVAL MAPRESULTATEN             550
C     DTPRI     R         1        INTERVAL PRINTRESULTATEN           560
C     DZ        R         1        LAAGDIKTE                          570
C     F         R         1        DEMPINGSKOEFFICIENT                580
C     G         R         1        GRAVITATIEKONSTANTE                590
C     GAM       R         1        KONSTANTE MUNK-ANDERSON            600
C     H         R         1        WATERDIEPTE                        610
C     HH        R         1        DIKTE TURBULENTE LAAG              620
C     HLAAG     R         1        DIKTE STARTLAAG MET R=KONSTANT     630
C     I         I         1        HULPVARIABELE                      640
C     IAP       I         1        STARTPLAATS DIFFKOEFF IMPULSIE     650
C     IAPHIS    I         1        STARTPLAATS DIFFKOEFF IMPULSIE     660
```

```
C     IAK       I          1     STARTPLAATS DIFFKOEFF DICHTHEID                    670
C     IAKHIS    I          1     STARTPLAATS DIFFKOEFF DICHTHEID                    680
C     ICP       I          1     NUMMER CHECKPOINT                                  690
C     ICKID     I          1     AANTAL PLAATSEN IN ARRAY                           700
C     IDY1      I          1     ARRAY MET KOORDINATEN CP'S                         710
C     IF        I          1     STARTPLAATS DEMPINGSKOEFF                          720
C     IFHIS     I          1     STARTPLAATS DEMPINGSKOEFF                          730
C     IIDY1     I          1     STARTPLAATS ARRAY IDY1                             740
C     III       I          1     TELLER                                             750
C     IJ        I          1     TELLER                                             760
C     IL        I          1     AANTAL LAGEN MET VERSCH DICHTHEID                  770
C     INUM      I          1     NUMMER BEREKENING                                  780
C     IP        I          1     VLAG OF LAAG TURBULENT IS                          790
C     IPLOT     I          1     VLAG OM TE PLOTTEN                                 800
C     IR        I          1     STARTPLAATS DICHTHEID                              810
C     IRDY1     I          1     STARTWAARDE ARRAY                                  820
C     IRDY2     I          1     STARTWAARDE ARRAY                                  830
C     IRDY3     I          1     STARTWAARDE ARRAY                                  840
C     IRHIS     I          1     STARTPLAATS DICHTHEID                              850
C     IRI       I          1     VLAG DEMPINGSFUNKTIE                               860
C     IRICH     I          1     STARTPLAATS RICHARDSONGETAL                        870
C     IRIHIS    I          1     STARTPLAATS RICHARDSONGETAL                        880
C     IRO       I          1     VLAG DICHTHEIDSVERDELING START                     890
C     ITEL      I          1     TELLER                                             900
C     ITHIS     I          1     HULPVARIABLE ARRAYVULLING                          910
C     ITT       I          1     STARTPLAATS RDY3                                   920
C     IU        I          1     STARTPLAATS SNELHEID                               930
C     IUHIS     I          1     STARTPLAATS SNELHEID                               940
C     J         I          1     KOORDINAAT PUNT                                    950
C     JCP       I          1     KOORDINAAT CHECKPUNT                               960
C     JT        I          1     KOORDINAAT TIJD                                    970
C     KCHECK    I          1     AANTAL CHECKPOINTS                                 980
C     KHIS      I          1     AANTAL HISTORYPUNTEN                               990
C     KLAAG     I          1     AANTAL LAGEN IN LAAG MET KONST DH                 1000
C     KMAX      I          1     AANTAL LAGEN                                      1010
C     KRO       I          1     AANTAL LAGEN MET R=C BOVENAAN                     1020
C     KT        I          1     AANTAL TIJDSTAPPEN                                1030
C     KTEL      I          1     HULPVARIABELE                                     1040
C     KTURB     I          1     AANTAL TURBULENTE LAGEN                           1050
C     KX        I          1     HULPVARIABELE                                     1060
C     KY        I          1     HULPVARIABELE                                     1070
C     LHIS      I          1     HULPVARIABELE                                     1080
C     LINES     I          1     REGELNUMMER PRINTER                               1090
C     LINP      I          1     MAXIMUM LINES                                     1100
C     MCP       I          1     NUMMER CHECKPOINT                                 1110
C     MF        I          1     NUMMER PLOT                                       1120
C     NPAGE     I          1     NUMMER PAGINA                                     1130
C     RBOVEN    R          1     DH BOVEN BIJ LIN DHV                              1140
C     RDY1      R          1     ARRAY MET GEGEVENS VAN PUNTEN                     1150
C     RDY2      R          1     ARRAY MET TIME-HISTORIES                          1160
C     RDY3      R          1     ARRAY MET TIJDSTIPPEN TURB WORDEN                 1170
C     RI        R          1     RICHARDSONGETAL                                   1180
C     RIC       R          1     KRITISCH RICHARDSONGETAL                          1190
C     RIK       R          1     KRITISCH RICHARDSONGETAL                          1200
C     RIKR      R          1     KRITISCH RICHARDSONGETAL                          1210
C     ROB       R          1     DICHTHEID ONDER                                   1220
C     ROLAAG    R          1     DICHTHEID LAAG MET R=KONSTANT                     1230
C     RONDER    R          1     DICHTHEID ONDER BIJ LIN DHV                       1240
C     ROO       R          1     DICHTHEID BOVEN                                   1250
C     RUNDAT    R          1     DATA-ARRAY                                        1260
C     SA        R          1     HULPDICHTHEID IN PUNT                             1270
C     SE        R          1     HULPDICHTHEID IN PUNT                             1280
C     THIS      R          1     TIJDSTIP HISTORYRESULATATEN                       1290
C     THS       R          1     AKTUELE TIJD IN PUNT                              1300
C     TIM       R          1     ARRAY TIJD                                        1310
C     TMAP      R          1     TIJDSTIP MAPRESULTATEN                            1320
```

```
C     TFR1      R          1         TIJDSTIP PRINTRESULTATEN                      1330
C     TTHRS     R          1         TOTALE REKENTIJD                              1340
C     US        R          1         WINDSCHUIFSPANNINGSSNELHEID                   1350
C     VA        R          1         HULPSNELHEID                                  1360
C     VB        R          1         HULPSNELHEID                                  1370
C                                                                                  1380
C                                                                                  1390
C                                                                                  1400
C                                                                                  1410
C                                                                                  1420
C     ************                                                                 1430
C     DECLARATIONS                                                                 1440
C     ************                                                                 1450
C                                                                                  1460
      REAL      RDY1  (      1)                                                    1470
      REAL      RDY2  (      1)                                                    1480
      REAL      RDY3  (      1)                                                    1490
      INTEGER   IDY1  (      1)                                                    1500
      CHARACTER*10  DATE, TIME, TIM                                                1510
      CHARACTER*20  RUNDAT                                                         1520
C                                                                                  1530
C                                                                                  1540
C                                                                                  1550
C                                                                                  1560
C                                                                                  1570
C     **********                                                                   1580
C     OPEN FILES                                                                   1590
C     **********                                                                   1600
C                                                                                  1610
      OPEN(5,FILE='TAPE5' ,STATUS='UNKNOWN',FORM=  'FORMATTED')                    1620
      OPEN(6,FILE='OUTPUT',STATUS='UNKNOWN',FORM=  'FORMATTED')                    1630
C                                                                                  1640
C                                                                                  1650
C                                                                                  1660
C                                                                                  1670
C                                                                                  1680
C     *************************                                                    1690
C     GET MACHINE DATE AND TIME                                                    1700
C     *************************                                                    1710
C                                                                                  1720
      TIM   =TIME()                                                                1730
      RUNDAT=DATE()//TIM(1:3)//':'//TIM(5:6)//':'//TIM(8:9)                        1740
C                                                                                  1750
C                                                                                  1760
C                                                                                  1770
C                                                                                  1780
C                                                                                  1790
C     ****************************                                                 1800
C     PRINT FIRST TWO BANNER PAGES                                                 1810
C     ****************************                                                 1820
C                                                                                  1830
      DO 15 J=1,2                                                                  1840
         WRITE(6,'('1',49X,'PAGE    1',////)')                                     1850
         CALL BANNER(' JOP1D ',7,6)                                                1860
         WRITE(6,'('0')')                                                          1870
         CALL BANNER('  RUN  ',7,6)                                               1880
         WRITE(6,'('0')')                                                          1890
         WRITE(6,'('0',36X,60('*'))')                                              1900
         WRITE(6,'(37X,'*',56X,'*')')                                              1910
         WRITE(6,'(37X,'* EEN-DIMENSIONAAL MODEL VOOR WINDTURBULE',                1920
     *          'NTIE IN EEN       *')')                                          1930
         WRITE(6,'(37X,'* GELAAGD MEER',45X,'*')')                                 1940
         WRITE(6,'(37X,'*',58X,'*')')                                              1950
         WRITE(6,'(37X,'* K.JOPPE',50X,'*')')                                      1960
         WRITE(6,'(37X,'* DELFT HYDRAULICS LABORATORY-DEPARTM',                    1970
     *          'ENT WL',14X,'*')')                                               1980
```

```
      WRITE(6,*(37X,*** TECHNISCHE HOGESCHOOL DELFT-AFDELING **,      1990
     *          **CIVIELE TECHNIEK     ***)*)                        2000
      WRITE(6,*(37X,**-**,58X,**-**)*)                               2010
      WRITE(6,*(37X,60(**-**),///)*)                                 2020
      WRITE(6,*(59X,**BEGIN OF PROGRAM**)*)                          2030
      WRITE(6,*(56X,**AT**,A20)*) RUNDAT                             2040
   15 CONTINUE                                                       2050
C                                                                    2060
C                                                                    2070
C                                                                    2080
C                                                                    2090
C                                                                    2100
C     ************************                                       2110
C     READ AND PRINT INPUT DATA                                      2120
C     ************************                                       2130
C                                                                    2140
      READ(5,*(4F10.0)*)       H,       DZ,     TTHRS, DT           2150
      READ(5,*(3F10.0)*)       DTPRI,   DTHIS,  DTMAP               2160
      READ(5,*(4I10  )*)       KCHECK,  IRO,    IRI,   INUM         2170
      READ(5,*(4F10.0)*)       CKA,     CKB,    ALFA,  DMOL         2180
      READ(5,*(4F10.0)*)       ALF,     BET,    GAM,   DEL          2190
      READ(5,*(4F10.0)*)       G,       CKAR,   CK,    CD           2200
      READ(5,*(3F10.0)*)       RIK,     RIC,    US                  2210
      NPAGE=2                                                        2220
      WRITE(6,*(**1**,T22,**INPUT REPORT**,T51,**PAGE**,I4,/)*) NPAGE 2230
      WRITE(6,*(**0   INUM  =**,I15,**          NUMMER BEREKENING**)*) 2240
     *            INUM                                              2250
      WRITE(6,*(**0   H     =**,F15.4,**    M     **,**TOTALE WATERDIE** 2260
     *          ,**PTE**)*) H                                       2270
      WRITE(6,*(**0   DZ    =**,F15.6,**    M     **,**LAAGDIKTE**)*) DZ 2280
      KMAX  =H/DZ+0.1                                                2290
      WRITE(6,*(**0   KMAX  =**,I15,**          **,**AANTAL LAGEN**)*) 2300
     *            KMAX                                              2310
      WRITE(6,*(**0   TTHRS =**,F15.4,**    S     **,**TOTALE REKEN**, 2320
     *          **TIJD**)*) TTHRS                                   2330
      WRITE(6,*(**0   DT    =**,F15.7,**    S     **,**TIJDSTAP**)*) DT 2340
      KT   =TTHRS/DT+0.1                                             2350
      WRITE(6,*(**0   KT    =**,I15,**          **,**AANTAL STAPPEN**)*) 2360
     *            KT                                                2370
      WRITE(6,*(**0   DTPRI =**,F15.7,**    S     **,**TIJDSTAP PRINT**, 2380
     *          **RESULTATEN**)*) DTPRI                             2390
      WRITE(6,*(**0   DTHIS =**,F15.7,**    S     **,**TIJDSTAP HISTOR**, 2400
     *          **YRESULTATEN**)*) DTHIS                            2410
      WRITE(6,*(**0   DTMAP =**,F15.7,**    S     **,**TIJDSTAP MAPRES**, 2420
     *          **ULTATEN**)*) DTMAP                                2430
C                                                                    2440
C                                                                    2450
C                                                                    2460
C                                                                    2470
C                                                                    2480
C     ******************************                                 2490
C     INLEZEN KOORDINATEN CHECKPOINTS                                2500
C     ******************************                                 2510
C                                                                    2520
      WRITE(6,*(**0   KCHECK=**,I15,**          AANTAL CHECKPOINTS**, 2530
     *       /)*) KCHECK                                           2540
      ICP    =1                                                      2550
      ICRID1 =ICP+KCHECK                                             2560
      CALL REGCMN( 1, IDY1, ICRID1, IIDY1)                           2570
      ICP    =ICP+IIDY1-1                                            2580
      DO 16 I=1,KCHECK                                               2590
         READ(5,*(I10)*) IDY1(ICP+I-1)                               2600
         WRITE(6,*(**    KOORDINAAT CHECKPOINT **,I10,** IS **,I10   2610
     *          )*) I, IDY1(ICP+I-1)                                2620
   16 CONTINUE                                                       2630
C                                                                    2640
```

```
C
C
C
C
C     ******************************************************
C     INLEZEN DICHTHEIDSVERDELING EN OPENEN ARRAYS
C     ******************************************************
C
      NPAGE=NPAGE+1
      WRITE(6,'(''1'',T22,''INPUT REPORT'',T51,''PAGE'',I4,/)')
     *         NPAGE
      WRITE(6,'(''0    IRO    ='',I10,''            =0 DICHTHEIDSVERDEL'',
     *         ''ING KONSTANT IN DE LAGEN'')') IRO
      WRITE(6,'(''                                  =1 DICHTHEIDSVERDE'',
     *         ''LING LINEAIR'',/)')
      IU    =1
      IR    =IU+KMAX
      IRICH =IR+KMAX
      IF    =IRICH+KMAX-1
      IAR   =IF+KMAX-1
      IAM   =IAR+KMAX-1
      ICRRD1=IAM+KMAX-1
      CALL REGCMM( 2, RDY1, ICRRD1, IRDY1)
      IU    =IU+IRDY1-1
      IR    =IR+IRDY1-1
      IRICH =IRICH+IRDY1-1
      IF    =IF+IRDY1-1
      IAR   =IAR+IRDY1-1
      IAM   =IAM+IRDY1-1
      IF (IRO.EQ.0) THEN
         READ(5,'(I10)') IL
         KTEL=0
         DO 20 I=1,IL
            READ(5,'(2F10.0)') HLAAG, ROLAAG
            KLAAG=HLAAG/DZ+0.1
            IF (I.EQ.1) THEN
               KRO=KLAAG
            ENDIF
            KX=KTEL+1
            KY=KTEL+KLAAG
            WRITE(6,'(''    DICHTHEID VAN LAGEN '',I10,'' T/M '',
     *                   I10,'' = '',F10.4)') KX, KY, ROLAAG
            DO 19 III=1,KLAAG
               KTEL=KTEL+1
               RDY1(IR+KTEL-1)=ROLAAG
   19       CONTINUE
   20    CONTINUE
      ELSE
         READ(5,'(F10.0)') RBOVEN
         READ(5,'(F10.0)') RONDER
         WRITE(6,'(''  DICHTHEID BOVENSTE LAAG IS '',F10.4)')
     *              RBOVEN
         WRITE(6,'(''  DICHTHEID ONDERSTE LAAG IS '',F10.4)')
     *              RONDER
         DRA =(RONDER-RBOVEN)/(KMAX-1.0)
         DO 25 I=1,KMAX
            RDY1(IR+I-1)=RBOVEN+DRA*(I-1.0)
   25    CONTINUE
      ENDIF
      ROO  =RDY1(IR)
      ROB  =RDY1(IR+KMAX-1)
C
C
C
C
C
```

```
C     *************************                                          3310
C     INLEZEN DEMPINGSKONSTANTEN                                        3320
C     *************************                                          3330
C                                                                       3340
      NPAGE=NPAGE+1                                                     3350
      WRITE(6,*(**1**,T22,**INPUT REPORT**,T51,**PAGE**,I4,/)*) NPAGE   3360
      WRITE(6,*(**0   IRI =**,I15,**  RICHARDSON-DEMPING:**)*) IRI      3370
      WRITE(6,*(** **,43X,**1  GEEN DEMPING**)*)                        3380
      WRITE(6,*(** **,43X,**2  METHODE KRANENBURG**)*)                  3390
      WRITE(6,*(** **,43X,**3  METHODE MAMAYEV**)*)                     3400
      WRITE(6,*(** **,43X,**4  METHODE MUNK=ANDERSON**,/)*)             3410
      IF (IRI.EQ.2) THEN                                                3420
          WRITE(6,*(**    RIC =**,F15.7,**  KRITISCH RICHARDSONGETAL**)* 3430
     *                ) RIC                                            3440
      ELSE                                                              3450
          IF (IRI.EQ.3) THEN                                            3460
              WRITE(6,*(**    CM  =**,F15.7,**  IMPULSIE-KONSTANTE**)*) 3470
     *                    CM                                           3480
              WRITE(6,*(**    CD  =**,F15.7,**  DICHTHEIDSKONSTANTE**)*) 3490
     *                    CD                                           3500
          ELSE                                                          3510
              IF (IRI.EQ.4) THEN                                        3520
                  WRITE(6,*(**    ALF =**,F15.7,**  IMPULSIE-MACHT**)*) 3530
     *                        ALF                                       3540
                  WRITE(6,*(**    BET =**,F15.7,**  IMPULSIE-KONSTANTE** 3550
     *                    )*) BET                                       3560
                  WRITE(6,*(**    GAM =**,F15.7,**  DICHTHEIDSMACHT**)*) 3570
     *                        GAM                                       3580
                  WRITE(6,*(**    DEL =**,F15.7,**  DICHTHEIDSKONSTANTE 3590
     *                  **)*) DEL                                       3600
              ENDIF                                                     3610
          ENDIF                                                         3620
      ENDIF                                                             3630
C                                                                       3640
C                                                                       3650
      WRITE(6,*(**0   G   =**,F15.7,**  GRAVITATIEKONSTANTE**)*) G      3660
      WRITE(6,*(**    CKAR=**,F15.7,**  KONSTANTE VAN VON KARMAN**)*)   3670
     *                CKAR                                             3680
      WRITE(6,*(**0   LAAG I IS TURBULENT ALS RI LE **,F10.4)*)  RIK    3690
      WRITE(6,*(**0   CKA =**,F15.7,**  IMPULSIE-KONSTANTE**)*)  CKA    3700
      WRITE(6,*(**    CKB =**,F15.7,**  DICHTHEIDSKONSTANTE**)*) CKB    3710
      WRITE(6,*(**    ALFA=**,F15.7)*)  ALFA                            3720
      WRITE(6,*(**    DMOL=**,F15.7,**  MOLEKULAIRE DIFFUSIEKOEFFICIE**, 3730
     *              **NT**)*) DMOL                                      3740
      WRITE(6,*(**0   US  =**,F15.7,**  WINDSCHUIFSPANNINGSSNELHEID**)*) 3750
     *                US                                               3760
C                                                                       3770
C                                                                       3780
C                                                                       3790
C                                                                       3800
C                                                                       3810
C     ********************                                              3820
C     VULLEN PLAATS-ARRAYS                                              3830
C     ********************                                              3840
C                                                                       3850
      DO 30 I=1,KMAX                                                    3860
         RDY1(IU+I-1)    =0.0                                           3870
   30 CONTINUE                                                          3880
      DO 40 I=1,KMAX-1                                                  3890
         RDY1(IRICH+I-1)=0.0                                            3900
         RDY1(IF+I-1)    =1.0                                           3910
         RDY1(IAR+I-1)   =0.0                                           3920
         RDY1(IAM+I-1)   =0.0                                           3930
   40 CONTINUE                                                          3940
C                                                                       3950
C                                                                       3960
```

```
C                                                                       3970
C                                                                       3980
C                                                                       3990
C     ******************************                                    4000
C     OPENEN EN VULLEN HISTORY-ARRAYS                                   4010
C     ******************************                                    4020
C                                                                       4030
      KHIS  =TTHRS/DTHIS+1.1                                            4040
      IRHIS =1                                                          4050
      IUHIS =IRHIS+KHIS*KCHECK                                          4060
      IRIHIS=IUHIS+KHIS*KCHECK                                          4070
      IFHIS =IRIHIS+KHIS*KCHECK                                         4080
      IARHIS=IFHIS+KHIS*KCHECK                                          4090
      IAMHIS=IARHIS+KHIS*KCHECK                                         4100
      ICRRD2=IAMHIS+KHIS*KCHECK                                         4110
      CALL REQCMM ( 3, RDY2, ICRRD2, IRDY2)                             4120
      IRHIS =IRHIS+IRDY2-1                                              4130
      IUHIS =IUHIS+IRDY2-1                                              4140
      IRIHIS=IRIHIS+IRDY2-1                                             4150
      IFHIS =IFHIS+IRDY2-1                                              4160
      IARHIS=IARHIS+IRDY2-1                                             4170
      IAMHIS=IAMHIS+IRDY2-1                                             4180
      DO 50 I=0,KCHECK-1                                                4190
         IJ  =I*KHIS                                                    4200
         JCP =IDY1(ICP+I)                                               4210
         RDY2(IRHIS+IJ) =RDY1(IR+JCP-1)                                 4220
         RDY2(IUHIS+IJ) =RDY1(IU+JCP-1)                                 4230
         RDY2(IRIHIS+IJ)=RDY1(IRICH+JCP-1)                              4240
         RDY2(IFHIS+IJ) =RDY1(IF+JCP-1)                                 4250
         RDY2(IARHIS+IJ)=RDY1(IAR+JCP-1)                                4260
         RDY2(IAMHIS+IJ)=RDY1(IAM+JCP-1)                                4270
   50 CONTINUE                                                          4280
      ITT   =1                                                          4290
      ICRRD3=ITT+KMAX                                                   4300
      CALL REQCMM ( 4, RDY3, ICRRD3, IRDY3)                             4310
      ITT   =IRDY3                                                      4320
C                                                                       4330
C                                                                       4340
C                                                                       4350
C                                                                       4360
C                                                                       4370
C     **********                                                        4380
C     BEREKENING                                                        4390
C     **********                                                        4400
C                                                                       4410
      THRS      =0.0                                                    4420
      TPRI      =DTPRI                                                  4430
      THIS      =DTHIS                                                  4440
      TMAP      =DTMAP                                                  4450
      ITHIS     =1                                                      4460
      ITEL      =0                                                      4470
      JT        =0                                                      4480
      KTURB     =0                                                      4490
      RDY3(ITT)=0.0                                                     4500
      HH        =ALFA*DZ                                                4510
      LINES     =1                                                      4520
      NPAGE     =NPAGE+1                                                4530
      LINF      =60                                                     4540
      IP        =0                                                      4550
      MF        =1                                                      4560
C                                                                       4570
C                                                                       4580
      WRITE(6,*('**1**',T22,**RESULTATEN**,T51,**PAGE**,I4,/)*)         4590
     *             NPAGE                                                4600
      LINES =LINES+2                                                    4610
      WRITE(6,*('0   TIJDSTIP **,F11.7,5X,**AANTAL TURBULENTE**,        4620
```

```
     *          ** LAGEN IS **,I10)**) THRS, KTURB                          4630
C                                                                           4640
C                                                                           4650
C                                                                           4660
C                                                                           4670
C                                                                           4680
C    ************************                                               4690
C    SNELHEID IN BOVENSTE LAAG                                              4700
C    ************************                                               4710
C                                                                           4720
      RDY1(IU)=DT/DZ*US**2                                                  4730
      HH      =HH+DZ                                                        4740
      KTURB   =KTURB+1                                                      4750
      RDY3(ITT+KTURB)=THRS                                                  4760
      JT      =JT+1                                                         4770
      THRS    =JT*DT                                                        4780
      LINES   =LINES+2                                                      4790
      WRITE(6,*(**0   TIJDSTIP **,F15.7,5X,**AANTAL TURBULENTE **,          4800
     *          ** LAGEN IS **,I10)**) THRS,KTURB                           4810
C                                                                           4820
C                                                                           4830
C                                                                           4840
C                                                                           4850
C                                                                           4860
C    ***********************************************                        4870
C    EERSTE LAAG MET DISKONTINUE DICHTHEIDSVERDELING                        4880
C    ***********************************************                        4890
C                                                                           4900
      IF (IRO.EQ.0) THEN                                                    4910
C                                                                           4920
C                                                                           4930
C                                                                           4940
C        ****************************                                       4950
C        SNELHEID IN 2 BOVENSTE LAGEN                                       4960
C        ****************************                                       4970
C                                                                           4980
         J=1                                                                4990
         CALL DIFFUS( RDY1(IR+J-1),  RDY1(IR+J), KTURB,                     5000
     *                RDY1(IU+J-1),  RDY1(IU+J), KRO,                       5010
     *                CKA, CKB, US,  CKAR, DMOL, AMA,                       5020
     *                IRI, RIC, HH,  DZ, CM, CD, RI,                        5030
     *                ALF, BET, GAM, DEL, F, G,  J, 0)                      5040
         VA         =RDY1(IU)+DT/DZ*(US**2-AMA*RDY1(IU)/DZ)                 5050
         RDY1(IU+1)=DT/DZ**2*AMA*RDY1(IU)                                   5060
         RDY1(IU)  =VA                                                      5070
         KTURB     =KTURB+1                                                 5080
         RDY3(ITT+KTURB)=THRS                                               5090
         HH        =HH+DZ                                                   5100
         JT        =JT+1                                                    5110
         THRS      =JT*DT                                                   5120
         LINES     =LINES+2                                                 5130
         WRITE(6,*(**0   TIJDSTIP **,F15.7,5X,**AANTAL TURBULENTE **,       5140
     *             **LAGEN IS **,I10)**) THRS, KTURB                        5150
C                                                                           5160
C                                                                           5170
C                                                                           5180
C        ******************************                                     5190
C        SNELHEID IN LAGEN 1 T/M KTURB+1                                    5200
C        ******************************                                     5210
C                                                                           5220
  100    IF (KTURB.LT.KRO.AND.JT.LT.KT) THEN                                5230
            J   =1                                                          5240
C                                                                           5250
C           *************************                                       5260
C           SNELHEID IN BOVENSTE LAAG                                       5270
C           *************************                                       5280
```

```
C                                                                       5290
            JCP =IDY1(JCP)                                              5300
            MCP =0                                                      5310
            JT  =JT+1                                                   5320
            THRS=JT*DT                                                  5330
            IP  =0                                                      5340
            CALL DIFFUS( RDY1(IR+J-1),  RDY1(IR+J), KTURB,              5350
     *                  RDY1(IU+J-1),  RDY1(IU+J), KRO,                5360
     *                  CKA, CKB, US,  CKAR, DMOL, AMA,                5370
     *                  IRI, RIC, HH,  DZ, CM, CD, RI,                 5380
     *                  ALF, BET, GAM, DEL, F, G,  J, 0)               5390
            VA =RDY1(IU)+DT/DZ*(US**2-AMA*(RDY1(IU)-RDY1(IU+1))/DZ)     5400
C                                                                       5410
C                                                                       5420
            IF (THRS.GE.TPRI) THEN                                      5430
                RDY1(IAM)=AMA                                           5440
            ENDIF                                                       5450
            IF (THRS.GE.THIS) THEN                                      5460
                IF (JCP.EQ.1) THEN                                      5470
                    RDY2(IAMHIS+ITHIS)=AMA                              5480
                    MCP =MCP+1                                          5490
                    JCP =IDY1(ICP+MCP)                                  5500
                ENDIF                                                   5510
            ENDIF                                                       5520
C                                                                       5530
C           ****************************                                5540
C           SNELHEID IN LAGEN 2 T/M KTURB                               5550
C           ****************************                                5560
C                                                                       5570
            DO 110 J=2,KTURB                                            5580
               CALL DIFFUS( RDY1(IR+J-1),  RDY1(IR+J), KTURB,           5590
     *                      RDY1(IU+J-1),  RDY1(IU+J), KRO,             5600
     *                      CKA, CKB, US,  CKAR, DMOL, AMB,             5610
     *                      IRI, RIC, HH,  DZ, CM, CD, RI,              5620
     *                      ALF, BET, GAM, DEL, F, G,  J, 0)            5630
               VB =RDY1(IU+J-1)+DT/DZ**2*(AMA*(RDY1(IU+J-2)-RDY1(       5640
     *             IU+J-1))-AMB*(RDY1(IU+J-1)-RDY1(IU+J)))             5650
               RDY1(IU+J-2)=VA                                          5660
               VA =VB                                                   5670
               AMA=AMB                                                  5680
C                                                                       5690
C                                                                       5700
               IF (THRS.GE.TPRI) THEN                                   5710
                   RDY1(IAM+J-1)=AMA                                    5720
               ENDIF                                                    5730
               IF (THRS.GE.THIS) THEN                                   5740
                   IF (JCP.EQ.J) THEN                                   5750
                       RDY2(IAMHIS+MCP*KHIS+ITHIS)=AMA                  5760
                       MCP =MCP+1                                       5770
                       JCP =IDY1(ICP+MCP)                               5780
                   ENDIF                                                5790
               ENDIF                                                    5800
C                                                                       5810
C                                                                       5820
  110       CONTINUE                                                    5830
C                                                                       5840
C           ************************                                    5850
C           SNELHEID IN LAAG KTURB+1                                    5860
C           ************************                                    5870
C                                                                       5880
            RDY1(IU+KTURB)   =RDY1(IU+KTURB)+DT/DZ**2*AMA*(RDY1(IU+     5890
     *                       KTURB-1)-RDY1(IU+KTURB))                   5900
            RDY1(IU+KTURB-1)=VA                                         5910
C                                                                       5920
C                                                                       5930
            KTURB            =KTURB+1                                   5940
```

```
            RDY3(ITT+KTURB) =THRS                                          5950
            HH              =HH+DZ                                         5960
            LINES =LINES+2                                                 5970
            WRITE(6,*('**0   TIJDSTIP **,F15.7,5X, **AANTAL TURBU**        5980
     *             ,**LENTE LAGEN IS **,I10)*) THRS, KTURB                 5990
            IF (LINES.GE.LINP) THEN                                        6000
                LINES =1                                                   6010
                NPAGE =NPAGE+1                                             6020
                WRITE(6,*('**1**,T22,**RESULTATEN**,T51,**PAGE**,          6030
     *                  I4,/)*) NPAGE                                      6040
                LINES =LINES+1                                             6050
            ENDIF                                                          6060
C                                                                          6070
C                                                                          6080
C                                                                          6090
C           ****************************************                       6100
C           AFDRUKKEN EN WEGSCHRIJVEN TUSSENRESULTATEN                     6110
C           ****************************************                       6120
C                                                                          6130
            IF (THRS.GE.TPRI) THEN                                         6140
                CALL MAPOUT( RDY1(IU), RDY1(IR),  RDY1(IRICH),             6150
     *                       RDY1(IF), RDY1(IAR), RDY1(IAM),               6160
     *                       NPAGE, KTURB, TTHRS, TPRI, KMAX)              6170
                TPRI =TPRI+DTPRI                                           6180
                LINES=2                                                    6190
                NPAGE=NPAGE+1                                              6200
                WRITE(6,*('**1**,T22,**RESULTATEN**,T51,**PAGE**,          6210
     *                  I4,/)*) NPAGE                                      6220
                IF (THRS.GE.TMAP) THEN                                     6230
                    CALL PLOTOV ( RDY1(IR), RDY1(IU), RDY1(IRICH),         6240
     *                            KMAX, MF, ROO, ROB, KTURB)               6250
                    TMAP=TMAP+DTMAP                                        6260
                ENDIF                                                      6270
            ENDIF                                                          6280
            IF (THRS.GE.THIS) THEN                                         6290
                DO 150 I=MCP,KCHECK-1                                      6300
                   RDY2(IAMHIS+I*KHIS+ITHIS)=RDY2(IAMHIS+I*KHIS+           6310
     *                                        ITHIS-1)                    6320
  150           CONTINUE                                                   6330
                DO 180 I=0,KCHECK-1                                        6340
                   JCP=IDY1(ICP+I)                                         6350
                   IJ =I*KHIS+ITHIS                                        6360
                   RDY2(IRIHIS+IJ)=RDY2(IRIHIS+IJ-1)                       6370
                   RDY2(IFHIS+IJ) =RDY2(IFHIS+IJ-1)                        6380
                   RDY2(IARHIS+IJ)=RDY2(IARHIS+IJ-1)                       6390
                   RDY2(IRHIS+IJ) =RDY1(IR+JCP-1)                          6400
                   RDY2(IUHIS+IJ) =RDY1(IU+JCP-1)                          6410
  180           CONTINUE                                                   6420
                THIS =THIS+DTHIS                                           6430
                ITHIS=ITHIS+1                                              6440
            ENDIF                                                          6450
C                                                                          6460
C                                                                          6470
            GOTO 100                                                       6480
        ENDIF                                                              6490
    ENDIF                                                                  6500
C                                                                          6510
C                                                                          6520
C                                                                          6530
C                                                                          6540
C                                                                          6550
C     ***********                                                          6560
C     TIJDKONTROLE                                                         6570
C     ***********                                                          6580
C                                                                          6590
      IF (NT.GE.NT) THEN                                                   6600
```

```
          GOTO 10000                                                        6610
        ENDIF                                                               6620
C                                                                           6630
C                                                                           6640
C                                                                           6650
C                                                                           6660
C                                                                           6670
C     ********************************************                          6680
C     EERSTE 2 LAGEN MET LINEAIRE DICHTHEIDSVERDELING                       6690
C     ********************************************                          6700
C                                                                           6710
      IF (IRO.EQ.1) THEN                                                    6720
C                                                                           6730
C                                                                           6740
C                                                                           6750
C         ****************************                                      6760
C         SNELHEID IN 2 BOVENSTE LAGEN                                      6770
C         ****************************                                      6780
C                                                                           6790
  200     J=1                                                               6800
          CALL DIFFUS( RDY1(IR+J-1),  RDY1(IR+J), KTURB,                    6810
     *                 RDY1(IU+J-1),  RDY1(IU+J), KRO,                      6820
     *                 CKA, CKB, US,  CKAR, DMOL, AMA,                      6830
     *                 IRI, RIC, HH,  DZ, CM, CD, RI,                       6840
     *                 ALF, BET, GAM, DEL, F, G,  J, 0)                     6850
          VA =RDY1(IU)+DT/DZ*(US**2-AMA*(RDY1(IU)-RDY1(IU+1))/DZ)           6860
          RDY1(IU+1)=RDY1(IU+1)+DT/DZ**2*AMA*(RDY1(IU)-RDY1(IU+1))          6870
          RDY1(IU)  =VA                                                     6880
          JT        =JT+1                                                   6890
          THRS      =JT*DT                                                  6900
C                                                                           6910
C                                                                           6920
          IF (THRS.GE.TPRI) THEN                                            6930
            TPRI=TPRI+DTPRI                                                 6940
          ENDIF                                                             6950
          JCP=IDY1(ICP)                                                     6960
          MCP=0                                                             6970
          IF (THRS.GE.THIS) THEN                                            6980
            IF (JCP.EQ.1) THEN                                              6990
              RDY2(IAMHIS+ITHIS)=AMA                                        7000
              RDY2(IRIHIS+ITHIS)=RI                                         7010
              RDY2(IFHIS+ITHIS) =F                                          7020
            ENDIF                                                           7030
          ENDIF                                                             7040
C                                                                           7050
C                                                                           7060
C                                                                           7070
C         ********************                                              7080
C         TURBULENTIEKRITERIUM                                              7090
C         ********************                                              7100
C                                                                           7110
C                                                                           7120
          CALL DEMP( 2, RIC, RDY1(IR+1), RDY1(IR), RDY1(IU+1),              7130
     *               RDY1(IU), RI, F, G, ALF, BET, GAM, DEL,                7140
     *               CM, CD, DZ, 0)                                         7150
          IF (RI.LE.RIK) THEN                                               7160
            KTURB=KTURB+1                                                   7170
            RDY3(ITT+KTURB)=THRS                                            7180
            HH    =HH+DZ                                                    7190
            IP    =1                                                        7200
          ENDIF                                                             7210
          IF (IP.EQ.1) THEN                                                 7220
            WRITE(6,*(**0   TIJDSTIP **,F15.7,5X,**AANTAL **,               7230
     *                **TURBULENTE LAGEN IS **,I10)*) THRS, KTURB           7240
            GOTO 300                                                        7250
          ENDIF                                                             7260
```

```
C
C
C
C          ****************************
C          DICHTHEID IN 2 BOVENSTE LAGEN
C          ****************************
C
           CALL DIFFUS( RDY1(IR+J-1),  RDY1(IR+J), KTURB,
     *                  RDY1(IU+J-1),  RDY1(IU+J), KRC,
     *                  CKA, CKB, US,  CKAR, DMOL, ARA,
     *                  IR1, RIC, HH,  DZ, CM, CD, RI,
     *                  ALF, BET, GAM, DEL, F, G,  J, 1)
           SA =RDY1(IR)+DT/DZ**2*ARA*(RDY1(IR+1)-RDY1(IR))
           RDY1(IR+1)=RDY1(IR+1)-DT/DZ**2*ARA*(RDY1(IR+1)-RDY1(IR))
           RDY1(IR)  =SA
           CALL DICHT( ITEL, RDY1(IR), KTURB, KMAX)
C
C
           IF (THRS.GE.THIS) THEN
               IF (JCP.EQ.1) THEN
                   RDY2(IARHIS+ITHIS)=ARA
                   MCP =MCP+1
                   JCP =IDY1(ICP+MCP)
               ENDIF
               DO 250 I=MCP,KCHECK-1
                  IJ=I*KHIS+ITHIS
                  RDY2(IAMHIS+IJ)=RDY2(IAMHIS+IJ-1)
                  RDY2(IARHIS+IJ)=RDY2(IARHIS+IJ-1)
                  RDY2(IRIHIS+IJ)=RDY2(IRIHIS+IJ-1)
                  RDY2(IFHIS+IJ) =RDY2(IFHIS+IJ-1)
  250          CONTINUE
               DO 280 I=0,KCHECK-1
                  IJ =I*KHIS+ITHIS
                  JCP=IDY1(ICP+I)
                  RDY2(IRHIS+IJ)=RDY1(IR+JCP-1)
                  RDY2(IUHIS+IJ)=RDY1(IU+JCP-1)
  280          CONTINUE
               THIS =THIS+DTHIS
               ITHIS=ITHIS+1
           ENDIF
C
C          ************
C          TIJDKONTROLE
C          ************
C
           IF (JT.GE.KT) THEN
               GOTO 10000
           ENDIF
C
           GOTO 200
  300      CONTINUE
       ENDIF
C
C
C
C
C
C      ************
C      TIJDKONTROLE
C      ************
C
       IF (JT.GE.KT) THEN
           GOTO 10000
       ENDIF
C
C
```

```
C                                                                       7930
C                                                                       7940
C                                                                       7950
C     **********************                                            7960
C     VOORTZETTING BEREKENING                                           7970
C     **********************                                            7980
C                                                                       7990
  350 IF (JT.LT.KT.AND.KTURB.LE.KMAX-2) THEN                            8000
        J=1                                                             8010
        IP=0                                                            8020
        JCP=IDY1(ICP)                                                   8030
        MCP=0                                                           8040
        JT=JT+1                                                         8050
        THRS=JT*DT                                                      8060
        IF (KTURB.EQ.KMAX-2) THEN                                       8070
            KT   =JT                                                    8080
            TTHRS=THRS                                                  8090
            TPRI =THRS                                                  8100
            THIS =THRS                                                  8110
            TMAP =THRS                                                  8120
        ENDIF                                                           8130
C                                                                       8140
C                                                                       8150
C                                                                       8160
C       ************************                                        8170
C       DICHTHEID IN BOVENSTE LAAG                                      8180
C       ************************                                        8190
C                                                                       8200
        CALL DIFFUS( RDY1(IR+J-1),  RDY1(IR+J), KTURB,                  8210
     *               RDY1(IU+J-1),  RDY1(IU+J), KRO,                    8220
     *               CKA, CKB, US,  CKAR, DMOL, ARA,                    8230
     *               IRI, RIC, HH,  DZ, CM, CD, RI,                     8240
     *               ALF, BET, GAM, DEL, F, G,  J, 1)                   8250
        SA =RDY1(IR)+DT/DZ**2*ARA*(RDY1(IR+1)-RDY1(IR))                 8260
C                                                                       8270
C                                                                       8280
        IF (THRS.GE.TPRI) THEN                                          8290
            RDY1(IAR)=ARA                                               8300
        ENDIF                                                           8310
        IF (THRS.GE.THIS) THEN                                          8320
            IF (JCP.EQ.1) THEN                                          8330
                RDY2(IARHIS+ITHIS)=ARA                                  8340
                MCP=MCP+1                                               8350
                JCP=IDY1(ICP+MCP)                                       8360
            ENDIF                                                       8370
        ENDIF                                                           8380
C                                                                       8390
C                                                                       8400
C                                                                       8410
C       ****************************                                    8420
C       DICHTHEID IN LAGEN 2 T/M KTURB                                  8430
C       ****************************                                    8440
C                                                                       8450
        DO 400 J=2,KTURB                                                8460
           CALL DIFFUS( RDY1(IR+J-1),  RDY1(IR+J), KTURB,               8470
     *                  RDY1(IU+J-1),  RDY1(IU+J), KRO,                8480
     *                  CKA, CKB, US,  CKAR, DMOL, ARB,                8490
     *                  IRI, RIC, HH,  DZ, CM, CD, RI,                 8500
     *                  ALF, BET, GAM, DEL, F, G,  J, 1)               8510
           SB =RDY1(IR+J-1)+DT/DZ**2*(ARB*(RDY1(IR+J)-RDY1(IR+J-1))     8520
     *         -ARA*(RDY1(IR+J-1)-RDY1(IR+J-2)))                        8530
           RDY1(IR+J-2)=SA                                              8540
           SA =SB                                                       8550
           ARA=ARB                                                      8560
C                                                                       8570
C                                                                       8580
```

```
            IF (THRS.GE.TPRI) THEN                                          8590
                RDY1(IAR+J-1)=ARA                                           8600
            ENDIF                                                           8610
            IF (THRS.GE.THIS) THEN                                          8620
                IF (JCP.EQ.J) THEN                                          8630
                    RDY2(IARHIS+MCP*KHIS+ITHIS)=ARA                         8640
                    MCP =MCP+1                                              8650
                    JCP =IDY1(ICP+MCP)                                      8660
                ENDIF                                                       8670
            ENDIF                                                           8680
C                                                                           8690
C                                                                           8700
  400   CONTINUE                                                            8710
C                                                                           8720
C                                                                           8730
C                                                                           8740
C           ************************                                        8750
C           DICHTHEID IN LAAG KTURB+1                                       8760
C           ************************                                        8770
C                                                                           8780
            RDY1(IR+KTURB)=RDY1(IR+KTURB)-DT/DZ**2*ARA*(RDY1(IR+KTURB)      8790
     *                    -RDY1(IR+KTURB-1))                                8800
            RDY1(IR+KTURB-1)=SA                                             8810
            CALL DICHT( ITEL, RDY1(IR), KTURB, KMAX)                        8820
C                                                                           8830
C                                                                           8840
            IF (THRS.GE.THIS) THEN                                          8850
                DO 450 I=MCP,KCHECK-1                                       8860
                   IJ =I*KHIS+ITHIS                                         8870
                   RDY2(IARHIS+IJ)=RDY2(IARHIS+IJ-1)                        8880
  450           CONTINUE                                                    8890
                DO 480 I=0,KCHECK-1                                         8900
                   IJ =I*KHIS+ITHIS                                         8910
                   JCP=IDY1(ICP+1)                                          8920
                   RDY2(IRHIS+IJ)=RDY1(IR+JCP-1)                            8930
  480           CONTINUE                                                    8940
                JCP=IDY1(ICP)                                               8950
                MCP=0                                                       8960
            ENDIF                                                           8970
C                                                                           8980
C                                                                           8990
C                                                                           9000
C           ************************                                        9010
C           SNELHEID IN BOVENSTE LAAG                                       9020
C           ************************                                        9030
C                                                                           9040
            J=1                                                             9050
            CALL DIFFUS( RDY1(IR+J-1),  RDY1(IR+J), KTURB,                  9060
     *                   RDY1(IU+J-1),  RDY1(IU+J), KRO,                    9070
     *                   CKA, CKB, US,  CKAR, DMOL, AMA,                    9080
     *                   IRI, RIC, HH,  DZ, CM, CD, RI,                     9090
     *                   ALF, BET, GAM, DEL, F, G,  J, 0)                   9100
C                                                                           9110
C                                                                           9120
            IF (THRS.GE.TPRI) THEN                                          9130
                RDY1(IAM)  =AMA                                             9140
                RDY1(IF)   =F                                               9150
                RDY1(IRICH)=RI                                              9160
            ENDIF                                                           9170
            IF (THRS.GE.THIS) THEN                                          9180
                IF (JCP.EQ.1) THEN                                          9190
                    RDY2(IAMHIS+ITHIS)=AMA                                  9200
                    RDY2(IFHIS+ITHIS) =F                                    9210
                    RDY2(IRIHIS+ITHIS)=RI                                   9220
                    MCP =MCP+1                                              9230
                    JCP =IDY1(ICP+MCP)                                      9240
```

```
            ENDIF                                                          9250
          ENDIF                                                            9260
C                                                                          9270
C                                                                          9280
          VA=RDY1(IU)+DT/DZ*(US**2-AMA*(RDY1(IU)-RDY1(IU+1))/DZ)           9290
C                                                                          9300
C                                                                          9310
C                                                                          9320
C         ****************************                                     9330
C         SNELHEID IN LAGEN 2 T/M KTURB                                    9340
C         ****************************                                     9350
C                                                                          9360
          DO 500 J=2,KTURB                                                 9370
             CALL DIFFUS( RDY1(IR+J-1),  RDY1(IR+J), KTURB,                9380
     *                    RDY1(IU+J-1),  RDY1(IU+J), KRO,                 9390
     *                    CKA, CKB, US,  CKAR, DMOL, AMB,                 9400
     *                    IRI, RIC, HH,  DZ, CM, CD, RI,                  9410
     *                    ALF, BET, GAM, DEL, F, G,  J, 0)                9420
             VB =RDY1(IU+J-1)+DT/DZ**2*(AMA*(RDY1(IU+J-2)-RDY1(IU+J-1))    9430
     *          -AMB*(RDY1(IU+J-1)-RDY1(IU+J)))                           9440
             RDY1(IU+J-2)=VA                                               9450
             VA =VB                                                        9460
             AMA=AMB                                                       9470
C                                                                          9480
C                                                                          9490
             IF (THRS.GE.TPRI) THEN                                        9500
                 RDY1(IAM+J-1)  =AMA                                       9510
                 RDY1(IF+J-1)   =F                                         9520
                 RDY1(IRICH+J-1)=RI                                        9530
             ENDIF                                                         9540
             IF (THRS.GE.THIS) THEN                                        9550
                 IF (JCP.EQ.J) THEN                                        9560
                     RDY2(IAMHIS+MCP*KHIS+ITHIS)=AMA                       9570
                     RDY2(IFHIS+MCP*KHIS+ITHIS) =F                         9580
                     RDY2(IRIHIS+MCP*KHIS+ITHIS)=RI                        9590
                     MCP =MCP+1                                            9600
                     JCP =IDY1(ICP+MCP)                                    9610
                 ENDIF                                                     9620
             ENDIF                                                         9630
C                                                                          9640
C                                                                          9650
 500      CONTINUE                                                         9660
C                                                                          9670
C                                                                          9680
C                                                                          9690
C         ************************                                         9700
C         SNELHEID IN LAAG KTURB+1                                         9710
C         ************************                                         9720
C                                                                          9730
          RDY1(IU+KTURB)=RDY1(IU+KTURB)+DT/DZ**2*AMA*(RDY1(IU+KTURB-1)     9740
     *                   -RDY1(IU+KTURB))                                  9750
          RDY1(IU+KTURB-1)=VA                                              9760
C                                                                          9770
C                                                                          9780
C                                                                          9790
C         ********************                                             9800
C         TURBULENTIEKRITERIUM                                             9810
C         ********************                                             9820
C                                                                          9830
          CALL DEMP( 2, 0.25, RDY1(IR+KTURB-2), RDY1(IR+KTURB-1),          9840
     *                        RDY1(IU+KTURB-2), RDY1(IU+KTURB-1),          9850
     *               RI,   F, G, ALF, BET, GAM, DEL, CM, CD, DZ, 0)        9860
          IF (RI.GE.RIK) THEN                                              9870
              RIKR=RIK                                                     9880
          ELSE                                                             9890
              RIKR=(RI+RIK)/2.                                             9900
```

```
      ENDIF                                                             9910
      CALL DEMP( 2, 0.25, RDY1(IR+KTURB-1), RDY1(IR+KTURB),             9920
     *                    RDY1(IU+KTURB-1), RDY1(IU+KTURB),             9930
     *            RI,   F, G, ALF, BET, GAM, DEL, CM, CD, DZ, 0)        9940
      IF (RI.LE.RIKR) THEN                                              9950
          KTURB=KTURB+1                                                 9960
          RDY3(ITT+KTURB)=THRS                                          9970
          HH=HH+DZ                                                      9980
          IP=1                                                          9990
      ENDIF                                                            10000
      IF (IP.EQ.1) THEN                                                10010
          WRITE(6,*('**0   TIJDSTIP **,F15.7,5X,**AANTAL TURBULENTE**  10020
     *             ,** LAGEN IS **,I10)*) THRS, KTURB                  10030
          LINES=LINES+2                                                10040
          IF (LINES.GE.LINP) THEN                                      10050
              LINES=1                                                  10060
              NPAGE=NPAGE+1                                            10070
              WRITE(6,*('**1**,T22,**RESULTATEN**,T51,**PAGE**,I4,/)*  10080
     *                  ) NPAGE                                        10090
              LINES=LINES+1                                            10100
          ENDIF                                                        10110
      ENDIF                                                            10120
C                                                                      10130
C                                                                      10140
C     ****************************************                         10150
C     AFDRUKKEN EN WEGSCHRIJVEN TUSSENRESULTATEN                       10160
C     ****************************************                         10170
C                                                                      10180
      IF (THRS.GE.TPRI) THEN                                           10190
          CALL MAPOUT( RDY1(IU), RDY1(IR),  RDY1(IRICH),               10200
     *                 RDY1(IF), RDY1(IAR), RDY1(IAM),                 10210
     *                 NPAGE, KTURB, TTHRS, TPRI, KMAX)                10220
          TPRI =TPRI+DTPRI                                             10230
          LINES=1                                                      10240
          NPAGE=NPAGE+1                                                10250
          WRITE(6,*('**1**,T22,**RESULTATEN**,T51,**PAGE**,I4,/)*)     10260
     *                NPAGE                                            10270
          LINES=LINES+1                                                10280
          IF (THRS.GE.TMAP) THEN                                       10290
              CALL PLOTOV ( RDY1(IR), RDY1(IU), RDY1(IRICH),           10300
     *                      KMAX, MF, ROO, ROB, KTURB)                 10310
              TMAP=TMAP+DTMAP                                          10320
          ENDIF                                                        10330
      ENDIF                                                            10340
      IF (THRS.GE.THIS) THEN                                           10350
          DO 550 I=MCP,KCHECK-1                                        10360
             IJ =I*KHIS+ITHIS                                          10370
             RDY2(IAMHIS+IJ)=RDY2(IAMHIS+IJ-1)                         10380
             RDY2(IRIHIS+IJ)=RDY2(IRIHIS+IJ-1)                         10390
             RDY2(IFHIS+IJ) =RDY2(IFHIS+IJ-1)                          10400
  550     CONTINUE                                                     10410
          DO 580 I=0,KCHECK-1                                          10420
             IJ =I*KHIS+ITHIS                                          10430
             JCP=IDY1(ICP+I)                                           10440
             RDY2(IUHIS+IJ)=RDY1(IU+JCP-1)                             10450
  580     CONTINUE                                                     10460
          THIS =THIS+DTHIS                                             10470
          ITHIS=ITHIS+1                                                10480
      ENDIF                                                            10490
C                                                                      10500
C                                                                      10510
      GOTO 350                                                         10520
    ENDIF                                                              10530
10500 CONTINUE                                                         10540
C                                                                      10550
                                                                       10560
```

```
C                                                                       10570
C                                                                       10580
C                                                                       10590
C                                                                       10600
C     ************************************                              10610
C     AFDRUKKEN EN PLOTTEN HISTORYRESULTATEN                            10620
C     ************************************                              10630
C                                                                       10640
      CALL PRIHIS ( RDY2(IRHIS), RDY2(IUHIS),  RDY2(IRIHIS),            10650
     *              RDY2(IFHIS), RDY2(IARHIS), RDY2(IAMHIS),            10660
     *              DTHIS, KHIS, THRS,  NPAGE, KCHECK)                  10670
      IF (TTHRS-AINT(TTHRS/DTHIS)*DTHIS.EQ.0.0) THEN                    10680
          LHIS=AINT(TTHRS/DTHIS)+1.                                     10690
      ELSE                                                              10700
          LHIS=AINT(TTHRS/DTHIS)+2.                                     10710
      ENDIF                                                             10720
      DO 10010 I=0,KCHECK-1                                             10730
         READ(5,*(I10)*) IPLOT                                          10740
         IF (IPLOT.EQ.1) THEN                                           10750
             IJ=I*KHIS                                                  10760
             CALL PLOTHI ( RDY2(IRHIS+IJ), RDY2(IUHIS+IJ), LHIS, ROO,   10770
     *                     ROB, DTHIS, MF, TTHRS)                       10780
         ENDIF                                                          10790
10010 CONTINUE                                                          10800
      CALL PLOTTU ( RDY3(ITT), KMAX, KTURB, TTHRS ,MF)                  10810
      CLOSE( 5)                                                         10820
      CLOSE( 6)                                                         10830
      END                                                               10840
C                                                                       10850
C                                                                       10860
C                                                                       10870
C                                                                       10880
C                                                                       10890
C     ************************************                              10900
      SUBROUTINE BANNER( TEKST, NTEKST, IPR)                            10910
C     ************************************                              10920
C                                                                       10930
C     DELFT HYDRAULICS LABORATORY     DEPARTMENT ESTUARIES AND SEAS     10940
C                                                                       10950
C     SIM3D.M0101.V0001      JULY 23 1984      C.WESSELS/P.KOOLE        10960
C                                                                       10970
C     FUNCTION               : PRINT A BANNER - 1 BLANK LINE            10980
C                                             -12 TEXT LINES            10990
C                                             - 1 BLANK LINE            11000
C     ENTRY                  : SIM3D.M0001.V0001  SIM3D                 11010
C     EXIT                   : CALLING MODULE                           11020
C     EXTERNALS              : NONE                                     11030
C     ERROR MESSAGES         : NONE                                     11040
C     LOGICAL UNITS          : LUN IPR = PRINT DEVICE                   11050
C     SUBROUTINES CALLED     : NONE                                     11060
C                                                                       11070
C                                                                       11080
C     PARAMETERS                                                        11090
C                                                                       11100
C     NAME      TYPE         I O T  LENGTH   DESCRIPTION                11110
C     ----      ----         - - -  ------   -----------                11120
C                                                                       11130
C     TEKST     CHAR*(*)     *      1        CHARACTER STRING FOR BANNER 11140
C                                             CHARACTERS MUST BE WITHIN 11150
C                                             THE COLLECTION:           11160
C                                             A B C D E F G H I J K L M N 11170
C                                             O P Q R S T U V W X Y Z 0 1 11180
C                                             2 3 4 5 6 7 8 9 *AND BLANK* 11190
C     NTEKST    INTEGER      *      1        LENGTH OF CHARACTER STRING 11200
C                                             (0.LE.NTEKST.LE.7)        11210
C     IPR       INTEGER      *      1        LUN PRINT DEVICE           11220
```

```
C                                                                       11230
C                                                                       11240
C     ******************************************************************11250
C                                                                       11260
C     DECLARATIONS                                                      11270
C                                                                       11280
      INTEGER        NTEKST,IPR,K(7)                                    11290
C                                                                       11300
      CHARACTER      TEKST*(*)                                          11310
      CHARACTER*6    BLANK                                              11320
      CHARACTER*12   CHAR(37,12)                                        11330
      CHARACTER*37   VERZ                                               11340
      CHARACTER*127 LINE                                                11350
C                                                                       11360
      DATA BLANK/'      '/                                              11370
C                                                                       11380
      DATA VERZ/' ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789'/                11390
C                                                                       11400
      DATA ((CHAR(I,J),I=1,4),J=1,12)                                   11410
     */'             ',' AAAAAAAAAA ',' BBBBBBBBBB ',' CCCCCCCCC ',    11420
     * '             ',' AAAAAAAAAAAA',' BBBBBBBBBBB',' CCCCCCCCCCC',  11430
     * '             ',' AA      AA',' BB      BB',' CC          C',    11440
     * '             ',' AA      AA',' BB      BB',' CC           ',    11450
     * '             ',' AA      AA',' BB      BB',' CC           ',    11460
     * '             ',' AAAAAAAAAA',' BBBBBBBBBB',' CC           ',    11470
     * '             ',' AAAAAAAAAA',' BBBBBBBBBB',' CC           ',    11480
     * '             ',' AA      AA',' BB      BB',' CC           ',    11490
     * '             ',' AA      AA',' BB      BB',' CC           ',    11500
     * '             ',' AA      AA',' BB      BB',' CC          C',    11510
     * '             ',' AA      AA',' BBBBBBBBBB',' CCCCCCCCCCC',      11520
     * '             ',' AA      AA',' BBBBBBBBBB ',' CCCCCCCCC '/      11530
      DATA ((CHAR(I,J),I=5,8),J=1,12)                                   11540
     */'DDDDDDDDDD ',' EEEEEEEEEE',' FFFFFFFFFF',' GGGGGGGGG ',        11550
     * 'DDDDDDDDDDD',' EEEEEEEEEE',' FFFFFFFFFF',' GGGGGGGGGGG',       11560
     * 'DD      DD',' EE        ',' FF        ',' GG        G',       11570
     * 'DD      DD',' EE        ',' FF        ',' GG         ',       11580
     * 'DD      DD',' EE        ',' FF        ',' GG         ',       11590
     * 'DD      DD',' EEEEEEE   ',' FFFFFF    ',' GG     GGGG ',       11600
     * 'DD      DD',' EEEEEEE   ',' FFFFFF    ',' GG    GGGGGG',       11610
     * 'DD      DD',' EE        ',' FF        ',' GG    G   GG',       11620
     * 'DD      DD',' EE        ',' FF        ',' GG        GG',       11630
     * 'DD      DD',' EE        ',' FF        ',' GG        GG',       11640
     * 'DDDDDDDDDDD',' EEEEEEEEEE',' FF        ',' GGGGGGGGGGG',      11650
     * 'DDDDDDDDDD ',' EEEEEEEEEE',' FF        ',' GGGGGGGGG '/       11660
      DATA ((CHAR(I,J),I=9,12),J=1,12)                                  11670
     */'HH      HH','   IIIIII   ','         JJ',' KK       KKK',      11680
     * 'HH      HH','   IIIIII   ','         JJ',' KK      KKK ',      11690
     * 'HH      HH','     II     ','         JJ',' KK     KKK  ',      11700
     * 'HH      HH','     II     ','         JJ',' KK    KKK   ',      11710
     * 'HH      HH','     II     ','         JJ',' KK   KKK    ',      11720
     * 'HHHHHHHHHH','     II     ','         JJ',' KK  KKK     ',      11730
     * 'HHHHHHHHHH','     II     ','         JJ',' KK KKKK     ',      11740
     * 'HH      HH','     II     ','         JJ',' KKKKKKKK    ',      11750
     * 'HH      HH','     II     ','         JJ',' KKKK  KKK   ',      11760
     * 'HH      HH','     II     ','J        JJ',' KKK    KKK  ',      11770
     * 'HH      HH','   IIIIII   ',' JJJJJJJJJJ',' KK       KKK ',     11780
     * 'HH      HH','   IIIIII   ',' JJJJJJJJJ ',' KK       KKK'/      11790
      DATA ((CHAR(I,J),I=13,16),J=1,12)                                 11800
     */'LL          ','MM      MM',' NN      NN',' 0000000000 ',       11810
     * 'LL          ','MMM    MMM',' NNN     NN',' 000000000000',      11820
     * 'LL          ','MMMM  MMMM',' NNNN    NN',' 00      00 ',       11830
     * 'LL          ','MM MMMM MM',' NN NN   NN',' 00      00 ',       11840
     * 'LL          ','MM  MM  MM',' NN  NN  NN',' 00      00 ',       11850
     * 'LL          ','MM      MM',' NN   NN NN',' 00      00 ',       11860
     * 'LL          ','MM      MM',' NN    NNNN',' 00      00 ',       11870
     * 'LL          ','MM      MM',' NN     NNN',' 00      00 ',       11880
```

```
*  'LL          ','MM          MM','NN     NNNNN','OO         OO',
*  'LL          ','MM          MM','NN      NNNN','OO         OO',
*  'LLLLLLLLLLLL','MM          MM','NN       NNN','OOOOOOOOOOOO',
*  'LLLLLLLLLLLL','MM          MM','NN        NN',' OOOOOOOOOO '/
   DATA ((CHAR(I,J),I=17,20),J=1,12)
*/'PPPPPPPPPPP ',' QQQQQQQQQQ ','RRRRRRRRRRR ',' SSSSSSSSSS ',
*  'PPPPPPPPPPPP','QQQQQQQQQQQQ','RRRRRRRRRRRR','SSSSSSSSSSSS',
*  'PP        PP','QQ        QQ','RR        RR','SS         S',
*  'PP        PP','QQ        QQ','RR        RR','SS          ',
*  'PP        PP','QQ        QQ','RR        RR','SS          ',
*  'PPPPPPPPPPPP','QQ        QQ','RRRRRRRRRRRR','SSSSSSSSSSS ',
*  'PPPPPPPPPPP ','QQ        QQ','RRRRRRRRRRR ',' SSSSSSSSSSS',
*  'PP          ','QQ        QQ','RR    RRR   ','          SS',
*  'PP          ','QQ    QQ  QQ','RR     RRR  ','          SS',
*  'PP          ','QQ     QQ QQ','RR      RRR ','S         SS',
*  'PP          ','QQQQQQQQQQQQ','RR       RRR','SSSSSSSSSSSS',
*  'PP          ',' QQQQQQQQQQ ','RR        RRR',' SSSSSSSSSS '/
   DATA ((CHAR(I,J),I=21,24),J=1,12)
*/'TTTTTTTTTTTT','UU        UU','VV        VV','WW        WW',
*  'TTTTTTTTTTTT','UU        UU','VV        VV','WW        WW',
*  '     TT     ','UU        UU','VV        VV','WW        WW',
*  '     TT     ','UU        UU','VV        VV','WW        WW',
*  '     TT     ','UU        UU','VV        VV','WW        WW',
*  '     TT     ','UU        UU','VV        VV','WW        WW',
*  '     TT     ','UU        UU',' VV      VV ','WW        WW',
*  '     TT     ','UU        UU','  VV    VV  ','WW   WW   WW',
*  '     TT     ','UU        UU','   VV  VV   ','WW   WW   WW',
*  '     TT     ','UUUUUUUUUUUU','    VVVV    ','WWWWWWWWWWWW',
*  '     TT     ',' UUUUUUUUUU ','     VV     ',' WWWWWWWWWW '/
   DATA ((CHAR(I,J),I=25,28),J=1,12)
*/'XX        XX','YY        YY','ZZZZZZZZZZZZ',' OOOOOOOOOO ',
*  'XXX      XXX','YYY      YYY','ZZZZZZZZZZZZ','OOOOOOOOOOOO',
*  ' XXX    XXX ',' YYY    YYY ','         ZZZ ','OO        OO',
*  '  XXX  XXX  ','  YYY  YYY  ','        ZZZ  ','OO        OO',
*  '   XXXXXX   ','   YYYYYY   ','       ZZZ   ','OO        OO',
*  '    XXXX    ','    YYYY    ','      ZZZ    ','OO   OO   OO',
*  '    XXXX    ','     YY     ','     ZZZ     ','OO   OO   OO',
*  '   XXXXXX   ','     YY     ','    ZZZ      ','OO        OO',
*  '  XXX  XXX  ','     YY     ','   ZZZ       ','OO        OO',
*  ' XXX    XXX ','     YY     ','  ZZZ        ','OO        OO',
*  'XXX      XXX','     YY     ','ZZZZZZZZZZZZ','OOOOOOOOOOOO',
*  'XX        XX','     YY     ','ZZZZZZZZZZZZ',' OOOOOOOOOO '/
   DATA ((CHAR(I,J),I=29,32),J=1,12)
*/'     11     ',' 2222222222 ',' 3333333333 ','      4444  ',
*  '    111     ','222222222222','333333333333','     44444  ',
*  '   1111     ','2         22','3         33','    444 44  ',
*  '  1  11     ','          22','          33','   444  44  ',
*  '     11     ','         222','          33','  444   44  ',
*  '     11     ','        222 ','      333333',' 444    44  ',
*  '     11     ','      222   ','      333333','444444444444',
*  '     11     ','    222     ','          33','444444444444',
*  '     11     ','  222       ','          33','        44  ',
*  '     11     ','222         ','3         33','        44  ',
*  '   111111   ','222222222222','333333333333','        44  ',
*  '   111111   ','222222222222',' 3333333333 ','        44  '/
   DATA ((CHAR(I,J),I=33,36),J=1,12)
*/'555555555555',' 6666666666 ','777777777777',' 8888888888 ',
*  '555555555555','666666666666','777777777777','888888888888',
*  '55          ','66         6','        777 ','88        88',
*  '55          ','66          ','       777  ','88        88',
*  '55          ','66          ','      777   ','88        88',
*  '55555555555 ','66666666666 ','   77777777 ','888888888888',
*  '555555555555','666666666666','   77777777 ','888888888888',
*  '          55','66        66','    777     ','88        88',
*  '          55','66        66','   777      ','88        88',
```

```
     * '5          55','66          66',' 777          ','68          88',
     * '555555555555','666666666666','777            ','8888888888888',
     * ' 555555555 ',' 6666666666 ','77              ',' 88888888888 */
      DATA ((CHAR(I,J),I=37,37),J=1,12)
     */' 9999999999 ',
     * '999999999999',
     * '99          99',
     * '99          99',
     * '99          99',
     * '999999999999',
     * ' 99999999999',
     * '            99',
     * '            99',
     * '9           99',
     * '999999999999',
     * ' 9999999999 '/
C
      N=MAX(0,MIN(NTEKST,7))
C
      IF (N.EQ.0) THEN
C
         WRITE(IPR,'(///////////////)')
C
      ELSE
C
         DO 10 I=1,7
            K(I)=1
   10    CONTINUE
C
         DO 20 I=1,N
         DO 15 J=1,37
C
            IF (TEKST(I:I).EQ.VERZ(J:J)) THEN
                K(I)=J
                GOTO 20
            ENDIF
C
   15    CONTINUE
   20    CONTINUE
C
         WRITE(IPR,'(1X)')
C
         DO 30 I=1,12
C
            LINE=' '//BLANK//CHAR(K(1),I)//BLANK//CHAR(K(2),I)//
     *                BLANK//CHAR(K(3),I)//BLANK//CHAR(K(4),I)//
     *                BLANK//CHAR(K(5),I)//BLANK//CHAR(K(6),I)//
     *                BLANK//CHAR(K(7),I)
C
            WRITE(IPR,'(A127)') LINE
C
   30    CONTINUE
C
         WRITE(IPR,'(1X)')
      ENDIF
C
      RETURN
      END
C
C
C
C
C     ****************************************************
      SUBROUTINE DEMP( JRI, FIC, FA,  RB,  UA, UB, RI, F, G,
     *                 AIE, FIT, DAM, DFI, CR, CD, DZ, IA)
```

```
C     ***************************************************                13210
C                                                                        13220
      IF (IRI.EQ.1) THEN                                                 13230
          F=1.0                                                          13240
          GOTO 40                                                        13250
      ELSE                                                               13260
          IF (RB-RA.LE.0.000001) THEN                                    13270
              F=1.0                                                      13280
              RI=0.0                                                     13290
              GOTO 40                                                    13300
          ELSE                                                           13310
              IF (UA-UB.LE.0.000001) THEN                                13320
                  F=0.0                                                  13330
                  RI=100000.0                                            13340
                  GOTO 40                                                13350
              ELSE                                                       13360
                  RI=2*G*DZ/(UB-UA)**2*(RB-RA)/(RB+RA)                   13370
                  IF (IRI.EQ.2) THEN                                     13380
                      GOTO 10                                            13390
                  ELSE                                                   13400
                      IF (IRI.EQ.3) THEN                                 13410
                          GOTO 20                                        13420
                      ELSE                                               13430
                          GOTO 30                                        13440
                      ENDIF                                              13450
                  ENDIF                                                  13460
              ENDIF                                                      13470
          ENDIF                                                          13480
      ENDIF                                                              13490
   10 IF (RI.GE.RIC) THEN                                                13500
          F=0.0                                                          13510
      ELSE                                                               13520
          F=1-RI/RIC                                                     13530
      ENDIF                                                              13540
      GOTO 40                                                            13550
   20 IF (RI.GE.30.0) THEN                                               13560
          F=0.0                                                          13570
      ELSE                                                               13580
          IF (IA.EQ.0) THEN                                              13590
              F=EXP(-CM*RI)                                              13600
          ELSE                                                           13610
              F=EXP(-CD*RI)                                              13620
          ENDIF                                                          13630
      ENDIF                                                              13640
      GOTO 40                                                            13650
   30 IF (RI.GE.100000.0) THEN                                           13660
          F=0.0                                                          13670
      ELSE                                                               13680
          IF (IA.EQ.0) THEN                                              13690
              F=(1+BET*RI)**(-ALF)                                       13700
          ELSE                                                           13710
              F=(1+GAM*RI)**(-DEL)                                       13720
          ENDIF                                                          13730
      ENDIF                                                              13740
      GOTO 40                                                            13750
   40 CONTINUE                                                           13760
      RETURN                                                             13770
      END                                                                13780
C                                                                        13790
C                                                                        13800
C                                                                        13810
C                                                                        13820
C                                                                        13830
C     ***************************************                            13840
      SUBROUTINE DICHT( JTEL, R, KTURB, RMAX )                           13850
C     ***************************************                            13860
```

```
C
C     PARAMETERS
C
C     NAME     TYPE   LENGTH      DESCRIPTION
C     ----     ----   ------      -----------
C
C     IMINN    I      1           KOORDINAAT ROMIN
C     IMIN0    I      1           HULPKOORDINAAT
C     IX       I      1           0 GEEN VOLGORDE
C                                 1 VOLGORDE
C     JJJ      I      1           0 GEEN VOLGORDE
C                                 1 VOLGORDE
C     KK       I      1           TELLER
C     KVOL     I      1           AANTAL LAGEN MET R=C
C     MB       I      1           AANTAL LAGEN MET R=C VOOR SPRONG
C     MBA      I      1           HULPLVARIABELE
C     MC       I      1           AANTAL LAGEN MET R=C NA SPRONG
C     MCA      I      1           HULPVARIABELE
C     R        R      KMAX        DICHTHEID
C     ROMIN    R      1           MINIMUM DICHTHEID
C     RVOL     R      1           GEWICHT AANTAL LAGEN
C
C     DECLARATIONS
C     ************
C
      REAL R(KMAX)
C
      IX=0
    5 JJJ=0
      DO 10 J=1,KTURB
         IF (R(J+1).LT.R(J)) THEN
             JJJ=1
             ITEL=ITEL+1
             IX=1
         ENDIF
   10 CONTINUE
      IF (JJJ.EQ.1) THEN
          IMIN0=0
          IMINN=0
   15     ROMIN=100000.0
          DO 20 J=IMIN0+1,KTURB+1
             IF (R(J).LT.ROMIN) THEN
                 IMINN=J
                 ROMIN=R(J)
            ENDIF
   20     CONTINUE
          KVOL=0
          RVOL=0.0
          DO 30 J=IMIN0+1,IMINN
             KVOL=KVOL+1
             RVOL=RVOL+R(J)
   30     CONTINUE
          DO 40 J=IMIN0+1,IMINN
             R(J)=RVOL/KVOL
   40     CONTINUE
          IMIN0=IMINN
          IF (IMIN0.EQ.KTURB+1) THEN
              GOTO 5
          ENDIF
          GOTO 15
      ENDIF
      IF (IX.EQ.1) THEN
          J=1
          MB=1
          MC=1
   50     IF (R(J+1).EQ.R(J)) THEN
```

```
13870
13880
13890
13900
13910
13920
13930
13940
13950
13960
13970
13980
13990
14000
14010
14020
14030
14040
14050
14060
14070
14080
14090
14100
14110
14120
14130
14140
14150
14160
14170
14180
14190
14200
14210
14220
14230
14240
14250
14260
14270
14280
14290
14300
14310
14320
14330
14340
14350
14360
14370
14380
14390
14400
14410
14420
14430
14440
14450
14460
14470
14480
14490
14500
14510
14520
```

```
      J=J+1                                                          14530
      IF (J.LT.KTURB) THEN                                           14540
          GOTO 50                                                    14550
      ELSE                                                           14560
          GOTO 100                                                   14570
      ENDIF                                                          14580
    ENDIF                                                            14590
    J=J+1                                                            14600
60  IF (R(J+1).EQ.R(J)) THEN                                         14610
      MB=MB+1                                                        14620
      IF (J.EQ.KTURB) THEN                                           14630
          GOTO 80                                                    14640
      ENDIF                                                          14650
      J=J+1                                                          14660
      GOTO 60                                                        14670
    ENDIF                                                            14680
    IF (J.EQ.KTURB) THEN                                             14690
      GOTO 100                                                       14700
    ENDIF                                                            14710
    J=J+1                                                            14720
    IF (MB.EQ.1) THEN                                                14730
      GOTO 60                                                        14740
    ELSE                                                             14750
      IF (MB.EQ.2) THEN                                              14760
          RODUM=(R(J)-R(J-1))/3                                      14770
          R(J-1)=R(J-1)+RODUM                                        14780
          R(J)=R(J)-RODUM                                            14790
          IF (J.EQ.KTURB) THEN                                       14800
              GOTO 100                                               14810
          ENDIF                                                      14820
          J=J+1                                                      14830
          MB=1                                                       14840
          GOTO 60                                                    14850
      ELSE                                                           14860
70        IF (R(J+1).EQ.R(J)) THEN                                   14870
            MC=MC+1                                                  14880
            IF (J.EQ.KTURB) THEN                                     14890
                GOTO 75                                              14900
            ENDIF                                                    14910
            J=J+1                                                    14920
            GOTO 70                                                  14930
          ENDIF                                                      14940
          RODUM=R(J)-R(J-MC)                                         14950
75        IF (MC.EQ.1) THEN                                          14960
            DO 76 KK=1,MB-1                                          14970
              R(J-MB+KK)=R(J-MB+KK)+KK*RODUM/(MB**2.0-1.0)           14980
76          CONTINUE                                                 14990
            R(J)=R(J)-MB*RODUM/2.0/(MB+1.0)                          15000
            IF (J.EQ.KTURB) THEN                                     15010
                GOTO 100                                             15020
            ENDIF                                                    15030
            J=J+1                                                    15040
            MB=1                                                     15050
            GOTO 60                                                  15060
          ELSE                                                       15070
            IF (J.EQ.KTURB) THEN                                     15080
                MC=MC-1                                              15090
                MCA=MC                                               15100
            ELSE                                                     15110
                MCA=MC/2                                             15120
            ENDIF                                                    15130
            DO 77 KK=2,MB                                            15140
              R(J-MC-MB+KK)=R(J-MC-MB+KK)+(KK-1)*MCA*RODUM/          15150
                            (MB+MCA)/(MB-1.0)                        15160
77          CONTINUE                                                 15170
            DO 78 KK=1,MCA                                           15180
```

```
                    R(J-MC+KK)=R(J-MC+KK)-(MCA+1-KK)*MB*RODUM/
     *                         (MCA+1)/(MB+MCA)
   78               CONTINUE
                    IF (J.EQ.KTURB) THEN
                        GOTO 100
                    ENDIF
                    MB=MC-MCA
                    MC=1
                    J=J+1
                    IF (MB.EQ.1) THEN
                        GOTO 60
                    ELSE
                        GOTO 70
                    ENDIF
                ENDIF
            ENDIF
        ENDIF
   80   MBA=MB-1
        RODUM=R(J)-R(J-MBA)
        R(J-MBA)=R(J-MBA)+RODUM/(MBA**2+2*MBA)
1       DO 85 KK=1,MBA
           R(J-MBA+KK)=R(J-MBA+KK)-(MBA-KK+1)/2.0*RODUM*(MBA+1)/
     *                 (MBA+2)
   85   CONTINUE
        GOTO 100
      ENDIF
  100 CONTINUE
      RETURN
      END
C
C
C
C
C
C     ****************************************************
      SUBROUTINE MAPOUT( AU,    AR,    ARI,   AF,   AAR, AAM,
     *                   NPAGE, KTURB, TTHRS, TPRI, KMAX)
C     ****************************************************
C
      REAL AU(KMAX)
      REAL AR(KMAX)
      REAL ARI(KMAX-1)
      REAL AF(KMAX-1)
      REAL AAR(KMAX-1)
      REAL AAM(KMAX-1)
C
      IF (TTHRS-TPRI.LT.0.1) THEN
          MK=KMAX-1
      ELSE
          MK=KTURB
      ENDIF
      MM=MK/25+1
      MY=25
      I=0
      DO 20 MZ=1,MM
         IF (MZ.EQ.MM) THEN
             MY=MK-25*(MZ-1)
         ENDIF
         NPAGE=NPAGE+1
         IF (TTHRS-TPRI.LT.0.1) THEN
             WRITE(6,'('**1**,T22,**EINDRESULTATEN**,T51,**PAGE**,I4,/)')
     *             NPAGE
         ELSE
             WRITE(6,'('**1**,T22,**TUSSENRESULTATEN**,T51,**PAGE**,I4,/)
     *                 ') NPAGE
         ENDIF
```

```
      WRITE(6,*('0',T51,'OVERZICHT    THRS=',F15.7)') TPRI          15850
      WRITE(6,*(' ',T51,'**********')')                             15860
      WRITE(6,*('0 LAAG',8X,'DICHTHEID',9X,'SNELHEID',20X,          15870
     *          'RI',16X,'F',15X,'AR',15X,'AM',/)')                 15880
      DO 10 MX=1,MY                                                 15890
         I=I+1                                                      15900
         WRITE(6,*(' ',I5,2X,F15.7,2X,F15.7)') I, AR(I), AU(I)      15910
         WRITE(6,*(' ',41X,F20.7,2X,F15.7,2X,F15.7,2X,F15.7)')      15920
     *         ARI(I), AF(I), AAR(I), AAM(I)                        15930
10    CONTINUE                                                      15940
20 CONTINUE                                                         15950
   I=I+1                                                            15960
   WRITE(6,*(' ',I5,2X,F15.7,2X,F15.7)') I, AR(I), AU(I)            15970
   RETURN                                                           15980
   END                                                              15990
C                                                                   16000
C                                                                   16010
C                                                                   16020
C                                                                   16030
C                                                                   16040
C     ******************************************************        16050
      SUBROUTINE PRIHIS (AR,    AU,   ARI,  AF,    AAR,  AAM,     16060
     *                   DTHIS, KHIS, THRS, NPAGE, KCHECK)          16070
C     ******************************************************        16080
C                                                                   16090
      REAL AR(KCHECK*KHIS)                                          16100
      REAL AU(KCHECK*KHIS)                                          16110
      REAL ARI(KCHECK*KHIS)                                         16120
      REAL AF(KCHECK*KHIS)                                          16130
      REAL AAR(KCHECK*KHIS)                                         16140
      REAL AAM(KCHECK*KHIS)                                         16150
      IF (THRS-ABS(THRS/DTHIS)*DTHIS.EQ.0) THEN                     16160
          LHIS=THRS/DTHIS+1                                         16170
      ELSE                                                          16180
          LHIS=THRS/DTHIS+2                                         16190
      ENDIF                                                         16200
      MM=LHIS/50+1                                                  16210
      DO 100 MCP=0,KCHECK-1                                         16220
         MPRI=MCP+1                                                 16230
         THIS=0.0                                                   16240
         IHIS=KHIS*MCP+1                                            16250
         DO 20 MZ=1,MM                                              16260
            IF (MZ.EQ.MM) THEN                                      16270
                MY=LHIS-50*(MZ-1)-1                                 16280
            ELSE                                                    16290
                MY=50                                               16300
            ENDIF                                                   16310
            NPAGE=NPAGE+1                                           16320
            WRITE (6,*('1',T22,'EINDRESULTATEN',T51,'PAGE',I4,/)')  16330
     *             NPAGE                                            16340
            WRITE (6,*('0',T51,'OVERZICHT   CHECKPOINT ',I4)') MPRI 16350
            WRITE (6,*(' ',T51,'**********')')                      16360
            WRITE (6,*('0',7X,'TIJDSTIP',8X,'DICHTHEID',9X,         16370
     *                 'SNELHEID',18X,'RI',16X,'F',15X,'AR',15X,    16380
     *                 'AM',/)')                                    16390
            DO 10 MX=1,MY                                           16400
               WRITE (6,*(' ',F15.7,2X,F15.7,2X,F15.7,2X,F18.7,2X,  16410
     *                F15.7,2X,F15.7,2X,F15.7)') THIS, AR(IHIS),    16420
     *                AU(IHIS), ARI(IHIS), AF(IHIS), AAR(IHIS),     16430
     *                AAM(IHIS)                                     16440
               THIS=THIS+DTHIS                                      16450
               IHIS=IHIS+1                                          16460
10          CONTINUE                                                16470
            IF (MZ.EQ.MM) THEN                                      16480
               WRITE (6,*(' ',F15.7,2X,F15.7,2X,F15.7,2X,F18.7,2X,  16490
     *                F15.7,2X,F15.7,2X,F15.7)') THRS, AR(IHIS),    16500
```

```
     *                    AU(IHIS), AFI(IHIS), AF(IHIS), AAR(IHIS),
     *                    AAM(IHIS)
           ENDIF
    20    CONTINUE
   100  CONTINUE
        RETURN
        END
C
C
C
C
C
C       ***************************************************************
        SUBROUTINE PLOTOV( YDATA, YDATB, YDATC, KMAX, MF, ROO, ROB, KTURB)
C       ***************************************************************
C
        REAL YDATA (KMAX)
        REAL YDATB (KMAX)
        REAL YDATC (KMAX-1)
        REAL YDAT  (500)
        REAL XDAT  (500)
        DIMENSION  IPAR(4)
        CHARACTER  ITAS(2)*20,ITLG(1)*20,ITGF(4)*50
        CHARACTER  CYF*3
        DATA ITAS/'        LAAG         ',
     *           '     DICHTHEID       '/,
     *      ITLG/'PICTURE                '/,
     *      ITGF/'DICHTHEID TEGEN DIEPTE                                  ',
     *           'K.JOPPE                                                 ',
     *           'WATERLOOPKUNDIG LABORATORIUM DELFT-AFDELING WILD         ',
     *           'TECHNISCHE HOGESCHOOL DELFT-AFDELING CIVIEL              '/
        NPS=KMAX+2
        IPAR(1)=1
        IPAR(2)=0
        IPAR(3)=1
        IPAR(4)=NPS
        DO 10 I=1,KMAX
           YDAT(I)=YDATA(I)
   10   CONTINUE
        YDAT(KMAX+1)=ROO
        YDAT(KMAX+2)=(ROB-ROO)/18.
        DO 20 I=1,KMAX
           XDAT(I)=I
   20   CONTINUE
        XDAT(KMAX+1)=1.
        XDAT(KMAX+2)=AINT(KMAX/15.0)+1.
        AX=AINT(KMAX/XDAT(KMAX+2))+1.
        WRITE(CYF,'(I3)')MF
        ITLG(1)(9:11)=CYF
        MF=MF+1
        CALL NEWPICT
        CALL GRAF(-1,XDAT,YDAT,NPS,1,ITAS,AX,19.0,IPAR,ITLG,ITGF)
        DO 30 I=1,KMAX
           YDAT(I)=YDATB(I)
   30   CONTINUE
        YDAT(KMAX+1)=0.
        YDAT(KMAX+2)=YDAT(1)/18.
        ITAS(2)='       SNELHEID       '
        ITGF(1)='SNELHEID TEGEN DIEPTE                                '
        WRITE(CYF,'(I3)')MF
        ITLG(1)(9:11)=CYF
        MF=MF+1
        CALL NEWPICT
        CALL GRAF(-1,XDAT,YDAT,NPS,1,ITAS,AX,19.0,IPAR,ITLG,ITGF)
        NPS=KTURB+1
        IPAR(4)=NPS
```

```
      DO 40 I=1,KTURB-1                                                 17180
         YDAT(I)=YDATC(I)                                               17190
   40 CONTINUE                                                          17200
      YDAT(KTURB)=0.                                                    17210
      YDAT(KTURB+1)=YDAT(KTURB-1)/18.                                   17220
      ITAS(2)='          RI          '                                  17230
      ITGF(1)='RI TEGEN DIEPTE                                          17240
      WRITE(CYF,'(I3)')MF                                               17250
      ITLG(1)(9:11)=CYF                                                 17260
      MF=MF+1                                                           17270
      XDAT(KTURB)=1.                                                    17280
      XDAT(KTURB+1)=XDAT(KMAX+2)                                        17290
      CALL NEWPICT                                                      17300
      CALL GRAF(-1,XDAT,YDAT,NPS,1,ITAS,AX,19.0,IPAR,ITLG,ITGF)         17310
      ITAS(2)='     DICHTHEID      '                                    17320
      ITGF(1)='DICHTHEID TEGEN DIEPTE                                   17330
      RETURN                                                            17340
      END                                                               17350
C                                                                       17360
C                                                                       17370
C                                                                       17380
C                                                                       17390
C                                                                       17400
C     ******************************************************************17410
      SUBROUTINE PLOTHI (YDATA, YDATB, LHIS, ROO, ROB, DTHIS, MF, TTHRS)17420
C     ******************************************************************17430
C                                                                       17440
      REAL YDATA(LHIS)                                                  17450
      REAL YDATB(LHIS)                                                  17460
      REAL XDAT(500)                                                    17470
      REAL YDAT(500)                                                    17480
      DIMENSION IPAR(4)                                                 17490
      CHARACTER ITAS(2)*20,ITLG(1)*20,ITGF(4)*50                        17500
      CHARACTER CYF*3                                                   17510
      DATA ITAS/'          TIJD          ',                             17520
     *         '       DICHTHEID        '/,                            17530
     *     ITLG/'PICTURE                 '/,                            17540
     *     ITGF/'DICHTHEID TEGEN TIJD                                  ',17550
     *          'K.JOPPE                                               ',17560
     *          'WATERLOOPKUNDIG LABORATORIUM DELFT-AFDELING WILD      ',17570
     *          'TECHNISCHE HOGESCHOOL DELFT-AFDELING CIVIEL           '/17580
      NPS=LHIS+2                                                        17590
      IPAR(1)=1                                                         17600
      IPAR(2)=0                                                         17610
      IPAR(3)=1                                                         17620
      IPAR(4)=NPS                                                       17630
      DO 10 I=1,LHIS-1                                                  17640
         YDAT(I)=YDATA(I)                                               17650
         XDAT(I)=(I-1)*DTHIS                                            17660
   10 CONTINUE                                                          17670
      YDAT(LHIS)=YDATA(LHIS)                                            17680
      YDAT(LHIS+1)=ROO                                                  17690
      YDAT(LHIS+2)=(ROB-ROO)/18.                                        17700
      XDAT(LHIS)=TTHRS                                                  17710
      XDAT(LHIS+1)=0.                                                   17720
      XDAT(LHIS+2)=TTHRS/15.                                            17730
      WRITE (CYF,'(I3)') MF                                             17740
      ITLG(1)(9:11)=CYF                                                 17750
      MF=MF+1                                                           17760
      CALL NEWPICT                                                      17770
      CALL GRAF(-1,XDAT,YDAT,NPS,1,ITAS,16.,19.,IPAR,ITLG,ITGF)         17780
      DO 20 I=1,LHIS                                                    17790
         YDAT(I)=YDATB(I)                                               17800
   20 CONTINUE                                                          17810
      YDAT(LHIS+1)=0.                                                   17820
      YDAT(LHIS+2)=YDAT(LHIS)/18.
```

```
      WRITE(CYF,'(I3)') MF                                                    17830
      ITLG(1)(9:11)=CYF                                                       17840
      MF=MF+1                                                                 17850
      ITAS(2)='      SNELHEID      '                                          17860
      ITGF(1)='SNELHEID TEGEN TIJD                                 '         17870
      CALL NEWPICT                                                            17880
      CALL GRAF (-1,XDAT,YDAT,NPS,1,ITAS,16.,19.,IPAR,ITLG,ITGF)              17890
      ITAS(2)='     DICHTHEID      '                                          17900
      ITGF(1)='DICHTHEID TEGEN TIJD                                '         17910
      RETURN                                                                  17920
      END                                                                     17930
C                                                                             17940
C                                                                             17950
C                                                                             17960
C                                                                             17970
C                                                                             17980
C     ***********************************************                         17990
      SUBROUTINE PLOTTU( XDAT, KMAX, KTURB, TTHRS ,MF)                        18000
C     ***********************************************                         18010
C                                                                             18020
      REAL XDAT(KMAX)                                                         18030
      REAL YDATA(500)                                                         18040
      REAL XDATA(500)                                                         18050
      DIMENSION IPAR(4)                                                       18060
      CHARACTER ITAS(2)*20,ITLG(1)*20,ITGF(4)*50                              18070
      CHARACTER CYF*3                                                         18080
      DATA ITAS/'         TIJD         ',                                     18090
     *         '         KTURB        '/,                                    18100
     *     ITLG/'PICTURE                '/,                                  18110
     *     ITGF/'AANTAL TURBULENTE LAGEN TEGEN TIJD                  ',       18120
     *          'K.JOPPE                                             ',       18130
     *          'WATERLOOPKUNDIG LABORATORIUM DELFT-AFDELING WILD    ',       18140
     *          'TECHNISCHE HOGESCHOOL DELFT-AFDELING CIVIEL         '/      18150
      NPS=KTURB+3                                                             18160
      IPAR(1)=1                                                               18170
      IPAR(2)=0                                                               18180
      IPAR(3)=1                                                               18190
      IPAR(4)=NPS                                                             18200
      DO 10 I=1,KTURB+1                                                       18210
         YDATA(I)=I-1.                                                        18220
   10 CONTINUE                                                                18230
      YDATA(KTURB+2)=0.                                                       18240
      YDATA(KTURB+3)=AINT(KMAX/18.)+1.                                        18250
      AY=AINT(KMAX/YDATA(KTURB+3))+1.                                         18260
      WRITE (CYF,'(I3)')MF                                                    18270
      ITLG(1)(9:11)=CYF                                                       18280
      DO 20 I=1,KTURB+1                                                       18290
         XDATA(I)=XDAT(I)                                                     18300
   20 CONTINUE                                                                18310
      XDATA(KTURB+2)=0.                                                       18320
      XDATA(KTURB+3)=TTHRS/15.                                                18330
      CALL NEWPICT                                                            18340
      CALL GRAF(-1,XDATA,YDATA,NPS,1,ITAS,16.0,AY,IPAR,ITLG,ITGF)             18350
      CALL PLOT(0.,0.,999)                                                    18360
      RETURN                                                                  18370
      END                                                                     18380
C                                                                             18390
C                                                                             18400
C                                                                             18410
C                                                                             18420
C                                                                             18430
C     ***************************************************                     18440
      SUBROUTINE DIFFUS( RA,  RB,  KTURB, UA,   UB,  KRO, CKA,                18450
     *                   CKB, US,  CKAR,  DHOL, DIF, IRI, RIC,                18460
     *                   FR,  DZ,  CM,    CD,   RI,  ALF, BET,                18470
     *                   CAM, DEL, F,     G,    J,   IA)                      18480
```

```
C     ****************************************************                18490
C                                                                         16500
      IF (KTURB.LT.KRO) THEN                                              18510
          FF=1                                                            18520
      ELSE                                                                18530
          CALL DEMPE( IRI, RIC, RA,  RB,  UA, UB, RI, F, G,               18540
     *                ALF, BET, GAM, DEL, CM, CD, DZ, IA)                 18550
          FF=F                                                            18560
      ENDIF                                                               18570
      IF (IA.EQ.0) THEN                                                   18580
          DIF=CKA*(DMOL+CKAR*US*J*DZ*(1.0-J*DZ/HH)*FF)                    18590
      ELSE                                                                18600
          DIF=CKB*(DMOL+CKAR*US*J*DZ*(1.0-J*DZ/HH)*FF)                    18610
      ENDIF                                                               18620
      RETURN                                                              18630
      END                                                                 18640
```

p.o. box 177 2600 mh delft the netherlands