Memo 72-28

SAND CONCENTRATION IN
AN OSCILLATORY FLOW

by

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Sand concentration in an oscillatory flow.
by Dr. H. S. Bakker.

1. Introduction.

This memo is a continuation of the report "Bottom friction and velocity distribution in an oscillatory flow" which has been presented first as Memo 72-23 [1] and later on, in extended version, as Study-report H. W. 72-10 [2].

In this study the velocity distribution was investigated occurring in an oscillatory flow; in which the water motion at an "infinite" distance from the bottom is described by (fig. 1)

$$U_{\infty} = \hat{U}_{\infty} \sin \omega t \quad \dots \dots \dots (1.1)$$

fig. 1

as stated already in [2] that study was a part of a much more extended investigation, of which the flow diagram is shown in fig. 2.

The following report deals about the sand concentration in an oscillatory flow; in the flow diagram the study is represented by the heavily framed rectangle.

The mechanism of the stirring up is investigated without paying attention to the bottom concentration. This will be treated in

an other memo. For the time being an arbitrary function of time of the bottom concentration has been assumed, which however can be replaced by a reasonable one at any time without changing the program essentially.

2. Suspended load.

The transport of suspended material S can be distinguished as:

- *] transport by convection cV_i
- diffusion transport, proportional with the concentration gradient $- \epsilon \nabla_i c$
- transport by own motion cW_i

Thus it can be written as:

$$S_i = cV_i - \epsilon \nabla_i c + cW_i \quad \dots \dots \dots (2.1)$$

in which the index i being ²⁵ 1, 2 or 3 denotes the component in one of the three coordinates, c is concentration, ϵ is diffusivity coefficient, V is the water velocity and W the velocity with respect to the water, ∇_i denotes the gradient.

Continuity gives:

$$\frac{\partial c}{\partial t} + \nabla_i S_i = 0 \quad \dots \dots \dots (2.2)$$

Substitution of (2.1) in (2.2) yields:

$$\frac{\partial c}{\partial t} + \nabla_i cV_i - \nabla_i (\epsilon \nabla_i c) + \nabla_i cW_i = 0 \quad \dots \dots \dots (2.3)$$

No use has been made of the continuity equation for the water movement yet:

$$\nabla_i V_i = 0 \quad \dots \dots \dots (2.4)$$

*] The text between inverted commas is translated from H.J. OPODM, literature review about transport of material by waves; memo 72-22 (in dutch).

Thus (2.3) can be written as:

$$\frac{\partial c}{\partial t} + V_i V_i c - \nabla_i (\epsilon \nabla_i c) + \nabla_i c W_i = 0 \quad \dots \dots \dots (2.5)$$

In the following the assumptions will be made:

- a. Only turbulent motion in vertical direction, i.e. same (mean) conditions in every horizontal plane;
- b. Convection transport caused by turbulent water motion will be considered as diffusion transport. All convection transport $V_i c$ will thus be in a horizontal plane, where c is everywhere constant and therefore the term $V_i V_i c$ will be zero.
- c. The diffusion coefficient ϵ will be assumed to be equal to the exchange coefficient of horizontal momentum in vertical direction.

$$\epsilon = \frac{\tau/\rho}{\frac{du}{dy}} = \frac{U'V'}{\frac{du}{dy}} = L^2 \left| \frac{du}{dy} \right| \quad \dots \dots \dots (2.6)$$

In [1] the "internal shear stress velocity" $\sqrt{\tau/\rho}$ has been calculated numerically in the case of an oscillatory flow over a horizontal bottom and has been called "p"

$$p = L \frac{du}{dy} \quad \dots \dots \dots (2.7)$$

Furthermore, the mixing length L (near the bottom) has been assumed proportional to the distance to the bottom

$$L = K y \quad \dots \dots \dots (2.8)$$

where K is the von KARMAN constant and y the distance to the bottom.

^{*)} so far OPDAM [3].

This makes ϵ :

$$\epsilon = K_y |p| \dots \dots \dots (2.9)$$

a. The own motion of the sediment will be assumed to be everywhere equal to the (constant) fall velocity - W . (W is thus defined as the velocity in negative y -direction; i.e. W is positive downwards)

Then (2.5) changes into

$$\frac{\partial c}{\partial t} - \frac{\partial}{\partial y} \left(\epsilon \frac{\partial c}{\partial y} \right) - W \frac{\partial c}{\partial y} = 0 \dots \dots \dots (2.10)$$

$$\frac{\partial c}{\partial t} - \frac{\partial}{\partial y} \left(\epsilon \frac{\partial c}{\partial y} + Wc \right) = 0 \dots \dots \dots (2.11)$$

This can be split into dynamic equation and continuity equation

$$S_y = -\epsilon \frac{\partial c}{\partial y} - Wc \dots \dots \dots (2.12)$$

and in the continuity equation

$$\frac{\partial c}{\partial t} + \frac{\partial S_y}{\partial y} = 0 \dots \dots \dots (2.13)$$

3. Numerical solution

3.1 Analysis

The equation is of the kind of the diffusion equation. For instance, considering (2.11) this can be written as

$$\frac{\partial c}{\partial t} - \epsilon \frac{\partial^2 c}{\partial y^2} - \frac{\partial \epsilon}{\partial y} \cdot \frac{\partial c}{\partial y} - W \frac{\partial c}{\partial y} = 0 \dots \dots \dots (3.1)$$

If the first two terms only were present, this would have given the diffusion equation.

Solving the equation with an explicit method, numerical instability occurs when:

$$\Delta t > \frac{(\Delta y)^2}{2 \epsilon_{\max}} \dots \dots \dots (3.2)$$

Because of relative fast changes near the bottom a small Δy is required and therefore the same solving method with the "pulsating grid" as used in [1] is chosen. The most simple solution is found by calculation of concentration and shear stress right after each other, in this way, that all computations run parallel.

3.2 Scaling.

As in [1] the following reference scales are used:

$$\alpha Y_0 = \alpha \hat{U}_n T \sqrt{f_w/2} \dots \dots \dots (3.3)$$

in which $\hat{U}_n$ is the amplitude of the oscillatory motion far from the bottom, T is the period of the motion and f_w is a friction coefficient.

$$f_w = \hat{\tau}_{bottom} / (\frac{1}{2} \rho \hat{U}_n^2) \dots \dots \dots (3.4)$$

As velocity scale will be used

$$U_0 = \hat{U}_n \sqrt{f_w/2} \dots \dots \dots (3.5)$$

Thus we define

$$y_* = y / \alpha \hat{U}_n T \sqrt{f_w/2} \dots \dots \dots (3.6)$$

$$\rho_* = \rho / \hat{U}_n \sqrt{f_w/2} \dots \dots \dots (3.7)$$

$$\epsilon_* = \epsilon / \alpha^2 Y_0 U_0$$

$$\varepsilon_* = \alpha y |p| / \alpha^2 Y_0 U_0 = y_* |p_*| \dots \dots \dots (3.8)$$

The reference unit ε_0 for ε thus equals:

$$\varepsilon_0 = \alpha^2 Y_0 U_0$$

$$\varepsilon_0 = \frac{1}{2} \alpha^2 \hat{Y}_w \hat{U}_w^2 T \dots \dots \dots (3.9)$$

as dimensionless fall velocity W is defined:

$$W_* = W / \alpha U_0 \dots \dots \dots (3.10^a)$$

$$W_* = W / \alpha \hat{U}_w \sqrt{\hat{Y}_w / 3} \dots \dots \dots (3.10^b)$$

Furthermore, as reference time the period of the oscillation T will be used:

$$t_* = t / T \dots \dots \dots (3.11)$$

Substitution of (3.6) to (3.11) into (2.11) gives the result

$$\frac{1}{T} \frac{\partial c}{\partial t_*} - \frac{1}{\alpha Y_0} \frac{\partial}{\partial y_*} (y_* |p_*| \alpha^2 Y_0 U_0 \frac{1}{\alpha Y_0} \frac{\partial c}{\partial y_*} + \alpha U_0 W_* c) = 0$$

as U_0 equals Y_0 / T , this can be written in a dimensionless way:

$$\frac{\partial c}{\partial t_*} - \frac{\partial}{\partial y_*} (y_* |p_*| \frac{\partial c}{\partial y_*} + W_* c) = 0 \dots \dots \dots (3.12)$$

For practical purposes (3.12) is rewritten as:

$$\frac{\partial c}{\partial t_*} = \varepsilon_* \frac{\partial^2 c}{\partial y_*^2} + \left(\frac{\partial \varepsilon_*}{\partial y_*} + W_* \right) \frac{\partial c}{\partial y_*} \dots \dots \dots (3.13)$$

3.3 Difference equation

Switching from differential equation to difference equation we assume, that all variables at time t are known. Denote the

sand concentration at time t by c and at time $t + \Delta t$ by c' .
Then (3.13) can be written

$$\frac{c'[Y_*] - c[Y_*]}{\Delta t_*} = \varepsilon_* [Y_*] \frac{c[Y_* + \Delta Y_*] - 2c[Y_*] + c[Y_* - \Delta Y_*]}{(\Delta Y_*)^2} + \left(\frac{\varepsilon_* [Y_* + \Delta Y_*] - \varepsilon_* [Y_* - \Delta Y_*]}{2\Delta Y_*} + W_* \right) \cdot \frac{c[Y_* + \Delta Y_*] - c[Y_* - \Delta Y_*]}{2\Delta Y_*} \quad \dots (3.14)$$

In the computer program the following notation has been used:

$c[Y_* + \Delta Y_*]$	has been called	c_{new}
$c[Y_*]$		c_{now}
$c[Y_* - \Delta Y_*]$		c_{old}
$\varepsilon_* [Y_* + \Delta Y_*]$		ε_{psnew}
$\varepsilon_* [Y_*]$		ε_{psnow}
$\varepsilon_* [Y_* - \Delta Y_*]$		ε_{psold}
$\Delta t_* / (\Delta Y_*)^2$		δt for Δt_* and ΔY_* belonging to the smallest grid,
		δt for the larger grid
$(\varepsilon_* [Y_* + \Delta Y_*] - \varepsilon_* [Y_* - \Delta Y_*] + 2W_* \Delta Y_*) / 4$	has been called	$\delta \varepsilon_{psdy}$

Thus (3.14) gets the shape

$$c_{now}' = c_{now} + \delta t [(\varepsilon_{psnow} + \delta \varepsilon_{psdy}) * c_{new} - 2 * \varepsilon_{psnow} * c_{now} + (\varepsilon_{psnow} - \delta \varepsilon_{psdy}) * c_{old}] \dots (3.15)$$

3.4 stability.

The numerical stability of the equation (3.13) as it is can be estimated from the stability of the equation

$$\frac{\partial c}{\partial t} = \varepsilon \frac{\partial^2 c}{\partial Y^2}$$

with constant value of ε . When this equation is transformed

into a difference equation, similar to (3.14), it is stable when

$$\Delta t \leq \frac{(\Delta y)^2}{2\varepsilon}$$

Returning to equation (3.14), it is known that ε equals $y_x \cdot p_x$ and thus the stability criterion becomes:

$$\Delta t \leq \frac{(\Delta y)^2}{2 |p_{x \max}| y_{x \max}} \dots \dots \dots (3.16)$$

This is equal to the stability criterion used in [1] and therefore it is reasonable to use the same numerical method as in [1] and even to carry out simultaneously the computation of p and of ε .

The numerical method of calculating p will be assumed to be known in this report; it has been treated in [1].

3.5 The procedure of calculation.

The calculation of p and of ε are carried out simultaneously. From three points p_{old} , p_{now} and p_{new} at line $t - \Delta t$ one point $p_{now'}$ at time t is calculated.

For the calculation of $p_{now'}$ at time t it is necessary to know the values of c_{old} , c_{now} and c_{new} at time $t - \Delta t$ as well as the values of p_{old} , p_{now} and p_{new} at time t in the same points, because $\varepsilon_{p_{old}}$, $\varepsilon_{p_{now}}$ and $\varepsilon_{p_{new}}$ have to be known.

The drawn line indicates the known values over the whole stretch of $p(t - \Delta t)$. The dashed line indicates the values of $c(t - \Delta t)$, which are also known. The half-drawn line shows the values of p at time t as far as calculated, up to point C.

It will be clear that the last point where the concentration can be calculated will be point B, as for the calculation of the concentration at point C the unknown value of the shear stress velocity p at point D is necessary.

This way of calculation has not been chosen because the variable grid length of the p -array as well as the c -array made the programming ^{too} complicated.

Another possibility would be to calculate in the same time p at time t and c in the same place at time $t-dt$ (fig. 3^b). However, the variable time step will cause c to lag one time step in the first grid, two in the second grid, four in the third and so on. This makes the programming complicated too.

Thus the way shown in fig. 3^c and fig. 3^a has been chosen. First p is calculated in all points of the wanted grids at a certain time t in the same way as mentioned in [1] (fig. 3^c). When this has been accomplished, c at time t is calculated in the same way in the same points at the same time (fig. 3^a). Values of c smaller than zero are replaced by zero.

3.6 Boundary conditions

The mathematical model as it is presented here is just a model for the stirring up of suspended load by waves. Up to now no attention has been paid to the boundary condition at the bottom, the bottom load. This requires a study in itself, which will be carried out in the future.

In the model as it will be presented here just an arbitrary boundary condition at the bottom has been chosen:

$$c_{y=0} = \text{abs}(p_{y=0}) \dots \dots \dots (3.17)$$

The boundary condition far from the bottom is

$$\left. \begin{array}{l} \text{everywhere} \\ \text{and always} \end{array} \right\} c \geq 0 \dots \dots \dots (3.18)$$

As initial condition has been chosen

$$p \equiv 0 \text{ and } c \equiv 0 \text{ for } t=0 \dots \dots \dots (3.19)$$

These conditions define the problem.

3.7 Input.

The input is nearly the same as in the TA-1 program.

Integer m : this defines Δy_* and Δt_*

$$\Delta y_* = y_{\max} * 2^{-m-1} \dots \dots \dots (3.20)$$

$$\Delta t_* = y_{\max} * 2^{-m-5} \dots \dots \dots (3.21)$$

Integer $y_{\max}$: the maximum y_* for which the computation has to be carried out.

Integer print : interval of time steps between which p and c must be printed.

Integer endt : number of wave periods, up to which the calculations has to be carried out.

real w : dimensionless fall velocity w_* , defined by (3.10)

array output : 11 times 2 values i and j , which indicate the y_* -values for which p and c have to be printed out.

These values are equal to:

$$y_* = 0.25 * y_{\max} * i * 2^{j-m} \dots \dots \dots (3.22)$$

The numbers i and j refer to the arrays $p(i,j)$

and $cl(i, j)$.

j denotes the number of the grid (being $1 \leq j \leq m$)
and i the number inside the grid (being $1 \leq i \leq 5$).

We refer to [1], fig. 17.

Combinations of $j=m$ with $i=4$ or $i=5$ should
not be used.

3.8 Flow diagram.

The computer program is just an extension of program
"TA1", the flow diagram of which is given in annex 1.

Annex 2. shows the extension, which speaks for itself.

3.9 The computer program itself.

A listing of the program, written in Algol-60, is
given in annex 3. As an example a computation has been
carried out with $w_* = .1$, the output of which is shown in
annex 5.

4. Acknowledgement.

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Leidschendam, 26 December 1972.

FLOW DIAGRAM TA1-PROGRAM - SHEAR STRESS BY WAVES
=====

FLOW DIAGRAM SA 1-PROGRAM
SHEAR STRESS AND SAND CONCENTRATION IN WAVES

SC	SOURCE STATEMENT	
00000	'BEGIN'	TA101A00
00000	'COMMENT'	SA101A30
00000	'INPUT:	TA101A31
00000	INT M =THE SMALLEST GRID LENGTH EQUALS YMAX*2**(-M-1).	TA101A32
00000	INT YMAX =MAX.DISTANCE ABOVE BOTTOM.	TA101A33
00000	INT,PRINT=INTERVAL IN TIMESTEPS BETWEEN WHICH P MUST BE	TA101A34
00000	PRINTED.	TA101A35
00000	INT ENDT =NUMBER OF WAVE PERIODS, UP TO WHICH THE CALCULATION	TA101A36
00000	HAS TO BE CARRIED OUT.	TA101A37
00000	REAL W =DIMENSIONLESS FALL VELOCITY	SA101A37
00000	REAL W =W/U(INF)/SQRT(FW/2)	SA101A37
00000	AR OUTPUT=11 TIMES 2 VALUES, I AND J, WHICH INDICATE THE	TA101A38
00000	Y-VALUES FOR WHICH P HAS TO BE PRINTED OUT. THESE	TA101A39
00000	VALUES ARE EQUAL TO: .25*YMAX*I*2**(-J-M), WITH	TA101A40
00000	1<=I<=5, 1<=J<=M. COMBINATIONS J=M WITH I=4 OR 5	TA101A41
00000	SHOULD NOT BE USED.;	TA101A42
00000	'REAL'T,DELT,DELT,DELT,DELT,PKUD,PKNU,PKNIEW,PNU,PNUL,PNIEW,Y,	TA101B00
00000	PI,ANGLE,DELLTY,UINF,SINUS,COSIN,SINDEL,COSDEL,W,WY,CNEW,	TA101C00
00000	EPSNEW,EPSSNOW,CNOW,CNUL,EPSSOLD,COLD,DEPSDY;	TA101C10
00001	'INTEGER'I,J,M,N,NN,A,PRINTN,PRINT,MMM,NPER,NHALF,NNPER,TIME,NT,	TA101D00
00001	ENDT,YMAX,TIME,GRENS,K,LIMIT;	TA101E00
00002	'PROCEDURE'SETTING(D,P,Q);'VALUE'D,P,Q;'CODE';	
00006	'PROCEDURE'PAGE(D);'VALUE'D;'CODE';	
00010	'PROCEDURE'BLANK(D,N);'VALUE'D,N;'CODE';	
00014	'PROCEDURE'LINE(D,N);'VALUE'D,N;'CODE';	
00018	'PROCEDURE'AFIX(D,M,N,X);'VALUE'D,M,N,X;'CODE';	
00023	'PROCEDURE'FIX(D,M,N,X);'VALUE'D,M,N,X;'CODE';	
00028	'PROCEDURE'FLO(D,M,N,X);'VALUE'D,M,N,X;'CODE';	
00033	'PROCEDURE'TYPE(D,X);'VALUE'D,X;'CODE';	
00038	'PROCEDURE'DRAW(BG,S,AANTL,POS,REGO,R,BLADH,X,Y);'VALUE'X,Y;	PRO01A00
00040	'INTEGER'G,BG,AANTL,POS,REGO,BLADH,R;	PRO01B00
00041	'ARRAY'X,Y;	PRO01C00
00042	'BEGIN'	PRO01D00
00042	'PROCEDURE'FLO(D,M,N,X);'VALUE'D,M,N,X;'CODE';	
00047	'PROCEDURE'FIX(D,M,N,X);'VALUE'D,M,N,X;'CODE';	
00052	'PROCEDURE'BLANK(D,N);'VALUE'D,N;'CODE';	
00056	'PROCEDURE'LINE(D,N);'VALUE'D,N;'CODE';	
00060	'REAL'MAXX,MAXY,MINX,MINY,SCHLX1,SCHLX2,SCHLY,SCHLX;	PRO01E00
00061	'INTEGER'GETAL,S,T,YY,P,U,POS0,I,N,M,AANTP;AANTP:=BG-G+1;	PRO01F00
00063	'BEGIN'	PRO01G00
00063	'INTEGER'ARRAY'PRINT(/O:POS/);	PRO01H00
00064	'ARRAY'XX(/1:(BLADH-REGO),1:AANTL/);	PRO01I00
00065	MAXX:=0;MINX:=0;	
00067	'FOR'S:=G'STEP'1'UNTIL'BG'DO'	PRO01K00
00067	'FOR'T:=1'STEP'1'UNTIL'AANTL'DO'	PRO01L00
00067	'BEGIN'IF'X(/S,T/)>MAXX'THEN'MAXX:=X(/S,T/);	PRO01M00
00068	IF'X(/S,T/)<MINX'THEN'MINX:=X(/S,T/);	PRO01N00
00069	'END';	PRO01O00
00070	MAXY:=Y(/BG /);	
00071	MINY:=Y(/G/);	
00072	POS0:=ABS(MINX)*POS/(ABS(MINX)+MAXX);	PRO01R00
00073	'IF'POS0=0'THEN'	
00073	'BEGIN'	
00073	SCHLX1:=MAXX/(POS-POS0);	
00074	SCHLX2:=SCHLX1;	
00075	'END'ELSE'	
00075	'IF'POS0=POS'THEN'	PRO01Y00
00075	'BEGIN'	
00075	SCHLX2:=ABS(MINX)/POS0;	
00076	SCHLX1:=SCHLX2;	
00077	'END'ELSE'	
00077	'BEGIN'	PRO02D00
00077	SCHLX1:=MAXX/(POS-POS0);	PRO02E00
00078	SCHLX2:=ABS(MINX)/POS0;	PRO02F00
00079	'END';	PRO02G00
00080	SCHLX:=IF'SCHLX1>SCHLX2'THEN'SCHLX1'ELSE'SCHLX2;	PRO02H00
00081	SCHLY:=(MAXY-MINY)/(BLADH-REGO);	PRO02I00
00082	'FOR'P:=1'STEP'1'UNTIL'AANTL'DO'	PRO02J00
00082	'BEGIN'XX(/BLADH-REGO,P/):=X(/BG ,P/)/SCHLX;	PRO02K00
00083	N:=BLADH-REGO;	PRO02L00
00084	M:=BG;	PRO02M00
00085	TERUG;	PRO02N00
00085	'IF'SCHLY*N<=Y(/M-1/)-MINY+SCHLY'THEN'	PRO02O00
00085	'BEGIN'M:=M-1;	PRO02P00
00086	'IF'M<G'THEN'GOTO'STOP;	PRO02Q00
00087	'GOTO'TERUG;	PRO02R00
00088	'END';	PRO02S00
00089	XX(/N,P/):=((Y(/M/)-MINY-SCHLY*N)/(Y(/M/)-Y(/M-1/))*	PRO02T00
00089	(X(/M-1,P/)-X(/M,P/))*X(/M,P/)/SCHLX;	PRO02U00
00090	N:=M-1;	PRO02V00
00091	'GOTO'TERUG;	
00092	STOP:XX(/1,P/):=X(/G,P/)/SCHLX;	
00093	'END';	

SC SOURCE STATEMENT

```

00094      I:=-1;
00095      'FOR' YY:=(BLADH-REGO)'STEP' 1 'UNTIL' 1 'DO'
00095      'BEGIN' 'FOR' P:=0 'STEP' 1 'UNTIL' POS 'DO'
00095      PRINT(/P/):=999;
00096      'FOR' P:=1 'STEP' 1 'UNTIL' AANTL 'DO'
00096      'BEGIN' GETAL:=XX(/YY,P/)+POS0;
00097      'IF' GETAL<0 'THEN' GETAL:=0;
00098      PRINT(/GETAL/):=P;
00099      'END';
00100      'IF' PRINT(/POS0/)=999 'THEN' PRINT(/POS0/):=888;
00101      I:=I+1;
00102      'IF' I>=2 'THEN' I:=0;
00103      'IF' I=0 'SCHLY*N=MINY' 'THEN' FIX(1,2,4,SCHLY*YY+MINY)
00103      'ELSE' BLANK(1,10);
00104      'FOR' P:=0 'STEP' 1 'UNTIL' POS 'DO'
00104      'BEGIN' 'IF' PRINT(/P/)=999 'THEN' 'BEGIN' 'IF' SCHLY*N=MINY 'THEN'
00104      OUTSTRING(1,(' ')); 'ELSE' BLANK(1,1); 'END' 'ELSE' 'BEGIN'
00105      'IF' PRINT(/P/)=888 'THEN' OUTSTRING(1,(' '));
00105      'ELSE' TYPE(1,PRINT(/P/)); 'END';
00107      'END';
00108      LINE(1,1);
00109      'END';
00110      FIX(1,2,4,SCHLY*(YY-1));
00111      'FOR' P:=0 'STEP' 1 'UNTIL' POS 'DO' OUTSTRING(1,(' '));
00112      LINE(1,1);
00113      BLANK(1,10); OUTSTRING(1,(' '));
00115      BLANK(1,POS0-1); OUTSTRING(1,(' '));
00117      BLANK(1,POS-POS0-1); OUTSTRING(1,(' '));
00119      LINE(1,1);
00120      BLANK(1,6);
00121      FIX(1,1,4,MINX);
00122      BLANK(1,POS0-5);
00123      OUTSTRING(1,(' '));
00124      BLANK(1,POS-POS0-3);
00125      FIX(1,1,4,MAXX);
00126      LINE(1,2);
00127      OUTSTRING(1,('1 POSITION REPRESENTS :')); FLD(1,5,2,SCHLY);
00129      LINE(1,1);
00130      OUTSTRING(1,('1 LINE REPRESENTS :')); FLD(1,5,2,SCHLY);
00132      'END';
00133      'END' DRAWPROCEDURE;
00134      SETTING(1,132,60);
00135      ININTEGER(0,H);
00136      ININTEGER(0,YMAX);
00137      ININTEGER(0,PRINTN);
00138      ININTEGER(0,ENDT);
00139      INREAL(0,W);
00140      MMM:=3*M;
00141      LIMIT:='IF' MMM<32 'THEN' 32 'ELSE' MMM;
00142      'BEGIN' 'ARRAY' P, HALF(/1:5,1:M/), YY(/1:MMM/), PP, UU(/1:7,1:MMM/),
00142      XXUT, XUT(/1:32,1:7/), YUT(/1:32/),
00142      CONC, UT(/0:MMM,1:32/), UCOS1, USIN1(/1:2/), C(/1:5,1:M/);
00143      'INTEGER' 'ARRAY' OUTPUT(/1:11,1:2/);
00144      'BOOLEAN' EVEN, NEVEN, THRU, LAST, PTRUE;
00145      'PROCEDURE' FORIER(ARAY); 'ARRAY' ARAY;
00147      'BEGIN' 'REAL' U, ALLU, MAXU, MINU, PHI;
00148      'ARRAY' ALLCOS, ALLSIN(/1:2/);
00149      ANGLE:=PI/16;
00150      'FOR' I:=1 'STEP' 1 'UNTIL' MMM 'DO'
00150      'BEGIN' ALLU:=0;
00151      MAXU:=MINU:=0;
00152      'FOR' J:=1,2 'DO' ALLCOS(/J/):=ALLSIN(/J/):=0;
00153      'FOR' TIME:=1 'STEP' 1 'UNTIL' 32 'DO'
00153      'BEGIN' U:=UT(/1,TIME/);
00154      ALLU:=ALLU+U;
00155      'FOR' J:=1,2 'DO'
00155      'BEGIN'
00155      ALLCOS(/J/):=ALLCOS(/J/)+U*COS((2*J-1)*TIME*ANGLE);
00156      ALLSIN(/J/):=ALLSIN(/J/)+U*SIN((2*J-1)*TIME*ANGLE);
00157      'END';
00158      'IF' U>MAXU 'THEN' MAXU:=U;
00159      'IF' U<MINU 'THEN' MINU:=U;
00160      'END';
00161      ARAY(/1,I/):=ALLU/32;
00162      'FOR' J:=1,2 'DO'
00162      'BEGIN'
00162      ARAY(/2*J,1/):=SQRT(ALLCOS(/J/)**2+ALLSIN(/J/)**2)/16;
00163      'IF' ARAY(/2*J,1/)>.00001 'THEN'
00163      'BEGIN'
00163      PHI:=ALLSIN(/J/)/ALLCOS(/J/);
00164      PHI:=ARCTAN(PHI)*180/PI;
00165      'IF' ALLCOS(/J/) < 0 'THEN' PHI:=PHI+90 'ELSE'
00165      PHI:=PHI+270;

```

PRO02Z00

PRO03A00

PRO03G00

PRO03J00

PRO03M00

PRO03O00

PRO03P00

PRO04F00

PRO04S00

PRO04U00

PRO04W00

TA101000

TA101P00

TA101Q00

TA101R00

TA101S00

SA101S50

TA101T00

TA101T01

TA101U00

TA101V01

TA101V00

TA101W00

TA101X00

TA101Y00

TA101Z00

TA102A00

TA102B00

TA102C00

TA102D00

TA102E00

TA102F00

TA102G00

TA102H00

TA102I00

TA102J00

TA102L00

TA102M00

TA102N00

TA102O00

TA102P00

TA102Q00

TA102R00

TA102S00

TA102T00

TA102U00

TA102W00

TA102W01

TA102W02

TA102W03

TA102X00

TA102Y00

TA102Y01

SC SOURCE STATEMENT

00166	ARRAY(/2*J+1,I/):=PHI;	TA102Z00
00167	'END' ELSE ARRAY(/2*J+1,I/):=0;	TA103A00
00168	'END';	TA103A10
00169	ARRAY(/6,I/):=MAXU;	TA103B00
00170	ARRAY(/7,I/):=MINU;	TA103C00
00171	'END' ARRAY CONTAINS RESP. THE MEAN, THE MODULE AND PHASE OF	TA103D00
00171	FIRST HARMONIC, IDEM OF SECOND HARMONIC, MAXIMUM AND	TA103E00
00171	MINIMUM VALUE OF THE VARIABLE, STORED IN UT-ARRAY;	TA103G00
00172	'END' FOR JER;	TA103H00
00173	'PROCEDURE' STORE(AR,ARRAY); 'ARRAY' AR,ARRAY;	SA103H02
00175	'BEGIN'	SA103H04
00175	'COMMENT' THIS PROCEDURE IS MEANT FOR STORAGE OF THE FINAL	SA103H06
00175	RESULTS OF COMPUTATIONS CARRIED OUT IN THE AUXILIARY	SA103H08
00175	ARRAY AR (GIVING AR AT ONE CERTAIN TIME) IN THE	SA103H10
00175	ARRAY ARRAY, WHICH HAS THE TWO DIMENSIONS Y (LEVEL)	SA103H12
00175	AND TIME;	SA103H14
00175	ARRAY(/1,TIME/):=AR(/1,1/);	SA103H16
00176	ARRAY(/2,TIME/):=AR(/2,1/);	SA103H18
00177	'FOR' J:=1 'STEP' 1 'UNTIL' M-1 'DO'	SA103H20
00177	'BEGIN'	SA103H22
00177	ARRAY(/3*J,TIME/):=AR(/3,J/);	SA103H24
00178	ARRAY(/3*J+1,TIME/):=AR(/4,J/);	SA103H26
00179	ARRAY(/3*J+2,TIME/):=AR(/5,J/);	SA103H28
00180	'END';	SA103H30
00181	ARRAY(/MM,TIME/):=AR(/3,M/); J:=M;	SA103H32
00183	'END' STORE;	SA103H34
00184	'PROCEDURE' PRLINE(ARRAY); 'AFRAY' ARRAY;	SA103H36
00186	'FOR' A:=1 'STEP' 1 'UNTIL' 11 'DO'	SA103H38
00186	'BEGIN'	SA103H40
00186	I:=OUTPUT(/A,1/);	SA103H42
00187	J:=OUTPUT(/A,2/);	SA103H44
00188	FIX(1,1,5,ARRAY(/I,J/));	SA103H46
00189	'END' PRLINE;	SA103H48
00190	'PROCEDURE' GRID(A); 'VALUE' A; 'INTEGER' A;	SA103H50
00193	'COMMENT' IN THIS PROCEDURE THE POINT P(/I,A/) IS CALCULATED WHEN PTRUE,	SA103H51
00193	ELSE C(/I,A/) IS CALCULATED.;	SA103H52
00193	'BEGIN' IF 'PTRUE' THEN	SA103H53
00193	'BEGIN' PKOUD:=PKNU;	SA103H54
00194	PKNU:=PKNIEW;	SA103H56
00195	PNU:=PNIEW;	SA103H58
00196	PNIEW:=P(/I+1,A/);	SA103H60
00197	PKNIEW:=PNIEW*ABS(PNIEW);	SA103H62
00198	P(/I,A/):=PNU+Y*DELTY*(PKOUD-2*PKNU+PKNIEW);	SA103H64
00199	'END' ELSE	SA103H66
00199	'BEGIN' EPSOLD:=EPSNOW;	SA103H66
00200	COLD:=CNOW;	SA103H68
00201	EPSNOW:=EPSNEW;	SA103H70
00202	CNOW:=CNEW;	SA103H72
00203	EPSNEW:=(Y+DELLY)*ABS(P(/I+1,A/));	SA103H74
00204	CNEW:=C(/I+1,A/);	SA103H76
00205	DEPSDY:=(EPSNEW-EPSOLD+NY)/4;	SA103H78
00206	C(/I,A/):=CNOW+DELLTY*((EPSNOW+DEPSDY)*CNEW-2*EPSNOW*CNOW	SA103H80
00206	+ (EPSNOW-DEPSDY)*COLD);	SA103H82
00207	'END';	SA103H84
00208	Y:=Y+DELLY;	SA103H86
00209	'END' GRID;	SA103H88
00210	'PROCEDURE' DRAWC(A,B,C,D,E,F,G,H);	
00211	'VALUE' A,B,C,D,E,F,G,H; 'INTEGER' A,B,C,D,E,F,G; 'REAL' H;	
00214	'BEGIN'	DRAWC300
00214	PAGE(1); OUTSTRING(1,('CONCENTRATION AS FUNCTION OF TIME FOR VARIOUS	SA108B03
00215	LEVELS	SA108B04
00216	'FOR' I:=1 'STEP' 1 'UNTIL' 32 'DO'	SA108B08
00216	'BEGIN' YUT(/I/):=1*.03125;	TA108B09
00217	K:=0;	TA108B10
00218	'FOR' J:=A,B,C,D,E,F,G 'DO'	TA108B11
00218	'BEGIN' K:=K+1;	TA108B12
00219	XUT(/I,K/):=CONC(/J,I/)+(K-1)*.75;	TA108B13
00220	'END';	TA108B14
00221	'END';	TA108B15
00222	LINE(1,1);	TA108B16
00223	OUTSTRING(1,('CURVE =')); BLANK(1,3);	TA108B17
00225	'FOR' K:=1 'STEP' 1 'UNTIL' 7 'DO'	TA108B18
00225	'BEGIN' TYPE(1,K);	TA108B19
00226	BLANK(1,3);	TA108B20
00227	'END';	TA108B21
00228	LINE(1,1);	TA108B22
00229	OUTSTRING(1,('LEVEL =')); BLANK(1,3);	TA108B23
00230	'FOR' J:=0 'STEP' 1 'UNTIL' 6 'DO'	TA108B25
00230	AFIX(1,2,3,J*H);	TA108B25
00231	LINE(1,1);	TA108B26
00232	OUTSTRING(1,('Y/KAPPA/U(INF)/T/SQRT(EW/2)')); LINE(1,1);	TA108B27
00234	DRAW(32,1,7,100,0,4,55,XUT,YUT);	TA108B23
00235	'END';	DRAWC400
00236	PI:=4*ARCTAN(1);	TA103I00

SC SOURCE STATEMENT

00237	NPER:=2*(M+5)*YMAX;	TA103J00
00238	'COMMENT' NPER=NUMBER OF TIME STEPS IN 1 WAVE PERIOD;	TA103K00
00238	NHALF:=NPER/2;	TA103L00
00239	INTARRAY(0,OUTPUT);	TA103L10
00240	OUTSTRING(1,('INPUT:')) ;LINE(1,1);	TA103L15
00242	OUTSTRING(1,('=====')) ;LINE(1,2);	TA103L20
00244	OUTSTRING(1,('M = ')) ;AFIX(1,3,0,M);LINE(1,1);	TA103L25
00247	OUTSTRING(1,('YMAX = ')) ;AFIX(1,3,0,YMAX);LINE(1,1);	TA103L30
00250	OUTSTRING(1,('PRINTN = ')) ;AFIX(1,3,0,PRINTN);LINE(1,1);	TA103L35
00253	OUTSTRING(1,('ENDT = ')) ;AFIX(1,3,0,ENDT);LINE(1,1);	TA103L40
00256	OUTSTRING(1,('W = ')) ;AFIX(1,3,2,W);LINE(1,1);	SA103L41
00259	OUTSTRING(1,('OUTPUT = ')) ;	TA103L45
00260	'FOR' J:=1'STEP'1'UNTIL'8'DO'	TA103L50
00260	'FOR' I:=1'STEP'1'UNTIL'2'DO'	TA103L55
00260	AFIX(1,3,0,OUTPUT(/J,I/)) ;LINE(1,1);BLANK(1,9);	TA103L60
00263	'FOR' J:=9'STEP'1'UNTIL'11'DO'	TA103L65
00263	'FOR' I:=1'STEP'1'UNTIL'2'DO'	TA103L70
00263	AFIX(1,3,0,OUTPUT(/J,I/)) ;PAGE(1);	TA103L75
00265	DELT:=1/NPER; DELY:=YMAX*2*(-M-1);DELY:=DELT/DELY/DELY;	TA103M00
00268	SINDEL:=SIN(2*PI*DELT);	TA103M01
00269	COSDEL:=COS(2*PI*DELT);	TA103M02
00270	SINUS:=0;COSIN:=1;	TA103M03
00272	NT:=0;LAST:='FALSE';	TA103N00
00274	TIME:=0;	TA103D00
00275	THRU:='FALSE';	TA103P00
00276	'FOR' I:=1'STEP'1'UNTIL'5'DO'	SA103Q00
00276	'FOR' J:=1'STEP'1'UNTIL'M'DO'	SA103R00
00276	'BEGIN' P(/I,J/):=0;	SA103S00
00277	C(/I,J/):=0;	SA103T00
00278	'END';	SA103U00
00279	BLANK(1,44);	SA103V00
00280	OUTSTRING(1,('SHEAR STRESS AND SAND CONCENTRATION IN WAVES')) ;	SA104A00
00280	;LINE(1,1);	SA104A10
00282	BLANK(1,44);	SA104B00
00283	OUTSTRING(1,('=====')) ;	SA104C00
00283	;LINE(1,2);	SA104D00
00285	BLANK(1,41);	SA104E00
00286	OUTSTRING(1,('VALUES OF SQR(2*TAU/FW/RHO)/U-INF TOP AND OF CONSA104F00	SA104F10
00286	C')) ;	TA104G00
00287	LINE(1,3);	TA104H00
00288	OUTSTRING(1,('Y-SCALE: 1=6*LABDAP*PI**2/64')) ;LINE(1,1);	TA104I00
00290	OUTSTRING(1,('T-SCALE: T=1 WAVE PERIOD')) ;LINE(1,2);	TA104K00
00292	OUTSTRING(1,(' T')) ;BLANK(1,6);	TA104L00
00294	OUTSTRING(1,('Y= 0.0')) ;BLANK(1,5);	TA104M00
00296	'FOR' A:=1'STEP'1'UNTIL'11'DO'	TA104N00
00296	'BEGIN' I:=OUTPUT(/A,1/);	TA104O00
00297	J:=OUTPUT(/A,2/);	TA104P00
00298	Y:=I*2*(-J-4)*YMAX;	TA104Q00
00299	FIX(1,2,4,Y);	TA104R00
00300	'END' HEADLINE; LINE(1,2);	TA104S00
00302	T:=0; N:=0; PRINT:=PRINTN; NEVEN:= PTRUE :='TRUE';TIM:=0;	TA104T00
00307	'COMMENT' NOW COMPUTATIONS IN INNERGRID;	SA104U00
00307	LATER: 'IF' PTRUE'THEN'	SA104U10
00307	'BEGIN'	SA104U20
00307	T:=T+DELT;	TA104V00
00308	N:=N+1;	TA104V50
00309	NEVEN:=-NEVEN;	TA104W01
00310	'IF' N>NPER'THEN'	TA104W02
00310	'BEGIN' N:=N-NPER;NT:=NT+1;LAST:=ENDT-NT<2 ;PRINT:=PRINTN;	TA104W03
00314	'END';	SA104W04
00315	'END';	SA104X00
00316	DELY:=Y:=DELY;	TA104Y00
00317	DELT:=DELT;	TA104Z00
00318	'IF' PTRUE'THEN'	TA105A00
00318	'BEGIN'	SA105B00
00318	PNUL:=PNU:=SINUS*COSDEL+COSIN*SINDEL;	TA105B10
00319	COSIN:=COSIN*COSDEL-SINUS*SINDEL;	TA105B20
00320	SINUS:=PNUL;	TA105C00
00321	'COMMENT' PNUL=SIN(2*PI*T);	TA105D00
00321	PNIEW:=P(/1,1/);	SA105D50
00322	PKNJ:=PNU*ABS(PNU);	SA105F00
00323	PKNIW:=PNIEW*ABS(PNIW);	SA105G00
00324	'END' ELSE'	SA105H00
00324	'BEGIN'	SA105I00
00324	WY:=2*W*DELY;	SA105J00
00325	CNUL:=ABS(PNUL);	SA105K00
00326	CNEW:=C(/1,1/);	SA105L00
00327	EPSNEW:=DELY*ABS(P(/1,1/));	SA105M00
00328	EPSNFW:=0;	SA105N00
00329	CNDW:=CNUL;	SA105O00
00330	'END';	TA105P00
00331	'FOR' I:=1'STEP'1'UNTIL'IF' NEVEN'THEN'3'ELSE'4'DO'	TA105Q00
00331	GRID(1);	TA105Q10
00332	'COMMENT'	

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00332      END COMPUTATIONS INNER GRID. IF N DIVISIBLE BY 2*(J-1) THEN
00332      THE FOLLOWING CALCULATIONS UP TO J-TH GRID;
00332      NN:=N;
00332      EVEN:=NEVEN;
00333      J:=1; 'FOR' J:=J+1 'WHILE' EVEN & J<=M 'DO'
00334      'BEGIN' 'IN':=NN/2;
00335      EVEN:=(NN/2-ENTIER(NN/2))<.1;
00336      DELLY:=DELLTY/2;
00337      DELLY:=2*DELLY;
00338      'IF' PTRUE 'THEN'
00339      'BEGIN'
00339      PNI:=P(/1,J/);
00339      PNIEW:=P(/2,J/);
00340      PKNI:=PNI*ABS(PNI);
00341      PKNIEW:=PNIEW*ABS(PNIEW);
00342      'END' 'ELSE'
00343      'BEGIN'
00343      NY:=2*NY;
00344      EPSNI:=DELLY*ABS(P(/1,J/));
00345      CNDA:=C(/1,J/);
00346      EPSNEW:=2*DELLY*ABS(P(/2,J/));
00347      CNEA:=C(/2,J/);
00348      'END';
00349      'FOR' I:=2 'STEP' 1 'UNTIL' 'IF' EVEN 'THEN' 3 'ELSE' 4 'DO'
00349      GRID(I);
00350      'COMMENT'
00350      END COMPUTATIONS IN SEPARATE GRIDS. NOW INTERACTION BETWEEN
00350      THE GRIDS. FIRST POINT LARGE GRID FROM SECOND POINT
00350      SMALLER GRID. FOURTH POINT SMALLER GRID FROM SECOND
00350      POINT LARGE GRID. FIFTH POINT SMALLER GRID INTERPOLATED
00350      BETWEEN SECOND AND THIRD POINT LARGE GRID;
00350      'IF' PTRUE 'THEN'
00350      'BEGIN'
00350      P(/1,J/):=P(/2,J-1/);
00351      P(/4,J-1/):=P(/2,J/);
00352      P(/5,J-1/):=(-P(/3,J-1/)+4.125*P(/2,J/)+3.25*P(/3,J/)-
00352      -0.375*P(/4,J/))/6;
00353      'END' 'ELSE'
00353      'BEGIN'
00353      C(/1,J/):=C(/2,J-1/);
00354      C(/4,J-1/):=C(/2,J/);
00355      C(/5,J-1/):=(-C(/3,J-1/)+4.125*C(/2,J/)+3.25*C(/3,J/)-
00355      -0.375*C(/4,J/))/6;
00356      'END';
00357      'IF' LAST 'AND' J=M 'AND' PTRUE 'THEN' TIM:=TIM+1;
00358      'IF' TIM=2*YMAX 'THEN'
00358      'BEGIN' 'IF' PTRUE 'THEN'
00358      'BEGIN'
00358      TIME:=TIME+1;
00359      STORE(P,UT);
00360      'END' 'ELSE'
00360      'BEGIN'
00360      TIM:=0;
00361      STORE(C,CONC);
00362      CONC(/O,TIME/):=CNUL;
00363      'END';
00364      'END' STORAGE;
00365      'END' COMPUTATIONS P AND C;
00366      PTRUE:=~PTRUE;
00367      'IF' ~PTRUE 'THEN' GOTO 'LATER';
00368      'IF' N=PRINT 'THEN'
00368      'BEGIN' PRINT:=PRINT+PRINTN;
00369      AFIX(1,1,3,T);
00370      OUTSTRING(1,(' P '));
00371      FIX(1,1,5,CNUL);
00372      PRLINE(P);
00373      LINE(1,1);
00374      BLANK(1,8);
00375      OUTSTRING(1,(' C '));
00376      FIX(1,1,5,CNUL);
00377      PRLINE(C);
00378      LINE(1,2);
00379      'END' PRINT P AND C;
00380      'IF' TIME=32 'THEN' GOTO 'OUT';
00381      'IF' THRU 'THEN' GOTO 'LATER';
00382      'IF' N=HALF 'THEN'
00382      'FOR' I:=1 'STEP' 1 'UNTIL' 5 'DO'
00382      'FOR' J:=1 'STEP' 1 'UNTIL' M 'DO'
00382      HALF(/1,J/):=P(/1,J/);
00383      'IF' N=NEPER 'THEN'
00383      'FOR' I:=1 'STEP' 1 'UNTIL' 5 'DO'
00383      'FOR' J:=1 'STEP' 1 'UNTIL' M 'DO'
00383      P(/1,J/):=(P(/1,J/)-HALF(/1,J/))/2;
00384      'COMMENT' CORRECTION P;
00384      THRU:=T>ENDT/2;
00385      GOTO 'LATER';
00386      OUT:
00386      DRAWC(0,MM-4,MM-5,MM-3,MM-2,MM-1,MM,.125*YMAX);
00387      DRAWC(0,1,2,3,4,5,6,DELY);
00388      'END';
00389      SLOT:
00389      'END';

```


INPUT:
=====

M = 4
YMAX = 1
PRINTN = 16
ENDT = 4
W = 10
OUTPUT = 1
4

1 2 3 4 5 1 3 2 4 3 3
1 3 3 4 1 4 1 5 1 3 2 4 3 3

SHEAR STRESS AND SAND CONCENTRATION IN WAVES

VALUES OF SQRT(2*TAU/FW/RHO)/U-INF TOP AND OF CONC

Y-SCALE: I=6*LABDAP*PI**2/64
T-SCALE: I=1 WAVE PERIOD

T	Y= 0.0	+0.0313	+0.0625	+0.0938	+0.1250	+0.1563	+0.1875	+0.2500	+0.3750	+0.5000	+0.6250	+0.7500
.031	P	+0.19509	+0.01392	+0.00005	+0.00000	-0.00000	+0.00000	+0.00000	+0.00000	+0.00000	-0.00000	+0.00000
	C	+0.19509	-0.00453	+0.00007	-0.00000	-0.00000	+0.00000	+0.00000	-0.00000	-0.00000	+0.00000	+0.00000
.063	P	+0.38263	+0.09891	+0.00538	+0.00000	+0.00000	+0.00000	+0.00000	+0.00000	+0.00000	-0.00000	+0.00000
	C	+0.38263	-0.00247	+0.00027	-0.00000	-0.00000	+0.00000	+0.00000	-0.00000	-0.00000	+0.00000	+0.00000
.094	P	+0.55557	+0.26436	+0.06580	+0.0079	+0.0009	+0.0000	+0.0000	+0.0000	+0.0000	-0.0000	+0.0000
	C	+0.55557	+0.04860	+0.00175	-0.00002	-0.00001	+0.00000	+0.00000	-0.00000	-0.00000	+0.00000	+0.00000
.125	P	+0.70711	+0.44460	+0.23234	+0.06296	+0.02058	+0.00008	+0.00002	+0.00000	+0.00000	-0.00000	+0.00000
	C	+0.70711	+0.13875	+0.02592	+0.00130	+0.00009	+0.00000	+0.00000	-0.00000	-0.00000	+0.00000	+0.00000
.156	P	+0.83147	+0.60349	+0.41194	+0.24476	+0.11377	+0.00536	+0.00145	+0.00000	+0.00000	-0.00000	+0.00000
	C	+0.83147	+0.22812	+0.07893	+0.02093	+0.00431	+0.00000	-0.00001	+0.00000	+0.00000	-0.00000	+0.00000
.188	P	+0.92383	+0.73225	+0.56627	+0.41604	+0.27770	+0.15179	+0.07425	+0.00003	+0.00000	-0.00000	+0.00000
	C	+0.92383	+0.30578	+0.13854	+0.06160	+0.02422	+0.00687	+0.00008	-0.00000	+0.00000	+0.00000	+0.00000
.219	P	+0.98079	+0.82550	+0.68552	+0.55518	+0.43280	+0.30990	+0.07425	+0.00109	+0.00024	-0.00002	+0.00000
	C	+0.98079	+0.36831	+0.19413	+0.10691	+0.05794	+0.02699	+0.00145	-0.00000	-0.00000	-0.00000	+0.00000
.250	P	+1.00000	+0.88138	+0.76799	+0.65894	+0.55413	+0.45323	+0.35506	+0.01072	+0.00276	+0.00011	+0.00000
	C	+1.00000	+0.41300	+0.24001	+0.14855	+0.09284	+0.05489	+0.02990	+0.00003	-0.00000	-0.00001	+0.00000
.281	P	+0.98079	+0.90002	+0.81373	+0.72622	+0.63912	+0.55377	+0.46772	+0.04836	+0.01385	+0.00146	+0.00001
	C	+0.98079	+0.43821	+0.27315	+0.18237	+0.12442	+0.08336	+0.05415	+0.00053	+0.00005	-0.00005	+0.00000
.313	P	+0.92383	+0.89275	+0.82366	+0.75740	+0.68788	+0.61784	+0.54578	+0.12781	+0.04078	+0.00682	+0.00016
	C	+0.92383	+0.44407	+0.29280	+0.20659	+0.14948	+0.10769	+0.07662	+0.00299	+0.00039	-0.00023	+0.00000
.344	P	+0.83147	+0.83294	+0.80145	+0.75639	+0.70440	+0.64961	+0.59159	+0.22822	+0.08429	+0.02054	+0.00117
	C	+0.83147	+0.43199	+0.29926	+0.22060	+0.16670	+0.12627	+0.09527	+0.00901	+0.00145	-0.00050	+0.00000
.375	P	+0.70711	+0.75591	+0.75235	+0.72918	+0.69328	+0.65333	+0.60908	+0.31275	+0.13826	+0.04552	+0.00479
	C	+0.70711	+0.40462	+0.29402	+0.22507	+0.17607	+0.13839	+0.10871	+0.01779	+0.00362	-0.00048	+0.00001
.406	P	+0.55557	+0.65898	+0.68337	+0.67936	+0.66081	+0.63503	+0.60385	+0.36730	+0.19400	+0.07948	+0.01353
	C	+0.55557	+0.36596	+0.27951	+0.22146	+0.17837	+0.14436	+0.11688	+0.02686	+0.00696	+0.00033	+0.00005
.438	P	+0.38263	+0.55202	+0.60311	+0.61762	+0.61395	+0.60099	+0.58148	+0.39699	+0.24312	+0.11691	+0.02942
	C	+0.38263	+0.32119	+0.25893	+0.21199	+0.17520	+0.14533	+0.12059	+0.03459	+0.01116	+0.00201	+0.00019
.469	P	+0.19509	+0.44916	+0.52151	+0.55128	+0.56006	+0.55790	+0.54822	+0.40950	+0.28022	+0.15287	+0.05258
	C	+0.19509	+0.27631	+0.23587	+0.19918	+0.16847	+0.14275	+0.12090	+0.04055	+0.01565	+0.00429	+0.00053
.500	P	+0.00000	+0.36493	+0.44929	+0.48876	+0.50647	+0.51242	+0.48848	+0.41044	+0.30409	+0.18436	+0.08080
	C	+0.00000	+0.23643	+0.21352	+0.18538	+0.15999	+0.13804	+0.08768	+0.04490	+0.01988	+0.00681	+0.00116
.531	P	+0.19509	+0.30257	+0.39284	+0.43655	+0.45917	+0.47019	+0.47331	+0.40396	+0.31673	+0.21009	+0.11046

	C	+.19509	+.21508	+.19510	+.17243	+.15123	+.13239	+.11564	+.08761	+.04792	+.02349	+.00932	+.00213
.563	P	-.39268	+.20777	+.33620	+.38937	+.41703	+.43233	+.43936	+.43589	+.39335	+.32140	+.22983	+.13805
	C	+.39268	+.20551	+.18246	+.16190	+.14336	+.12676	+.11188	+.08663	+.04992	+.02640	+.01168	+.00341
.594	P	+.55557	+.03134	+.27075	+.33945	+.37472	+.39544	+.40664	+.41025	+.38058	+.32103	+.24397	+.16124
	C	+.55557	+.17525	+.17082	+.15304	+.13642	+.12151	+.10811	+.08516	+.05116	+.02865	+.01281	+.00488
.625	P	-.70711	-.27946	+.19703	+.29152	+.33404	+.35973	+.37465	+.38477	+.36645	+.31742	+.25310	+.17909
	C	+.70711	+.16327	+.15777	+.14406	+.12967	+.11644	+.10436	+.08340	+.05184	+.03035	+.01571	+.00644
.656	P	-.83147	-.52425	-.06946	+.22139	+.28392	+.32053	+.34139	+.35900	+.35146	+.31161	+.25796	+.19172
	C	+.83147	+.30574	+.15355	+.12632	+.12335	+.11145	+.10057	+.08140	+.05208	+.03162	+.01737	+.00797
.688	P	-.92388	-.67175	-.41972	+.02034	+.19016	+.26955	+.30123	+.33047	+.33539	+.30406	+.25928	+.19982
	C	+.92388	+.38930	+.22291	+.13764	+.12214	+.10864	+.09707	+.07929	+.05198	+.03254	+.01877	+.00939
.719	P	-.98079	-.78010	-.58199	-.37269	-.00874	+.16975	+.24395	+.29302	+.31670	+.28447	+.25759	+.20421
	C	+.98079	+.44926	+.28229	+.19041	+.12100	+.09747	+.09388	+.07713	+.05159	+.03315	+.01994	+.01065
.750	P	-1.00000	-.84432	-.68374	-.51004	-.30606	-.04780	+.17344	+.25165	+.29554	+.28262	+.25310	+.20554
	C	+1.00000	+.48849	+.32454	+.22459	+.14191	+.10588	+.09320	+.07605	+.05101	+.03353	+.02087	+.01173
.781	P	-.98079	-.36862	-.74643	-.61591	-.48295	-.25771	-.03032	+.16652	+.26846	+.26787	+.24626	+.20438
	C	+.98079	+.50529	+.34774	+.25414	+.19244	+.13736	+.09637	+.07765	+.05040	+.03371	+.02156	+.01263
.813	P	-.92388	-.35578	-.76662	-.66588	-.55623	-.44275	-.30775	+.05123	+.23410	+.24859	+.23632	+.20091
	C	+.92388	+.50547	+.36436	+.27893	+.21796	+.16546	+.12370	+.07831	+.04967	+.03372	+.02206	+.01335
.844	P	-.83147	-.80921	-.75336	-.68225	-.60050	-.51674	-.41169	-.09044	+.20391	+.22917	+.22452	+.19535
	C	+.83147	+.48976	+.36688	+.28964	+.23374	+.19018	+.15266	+.07821	+.04880	+.03363	+.02242	+.01389
.875	P	-.70711	-.73440	-.70926	-.66154	-.59982	-.53008	-.44715	-.23090	+.16853	+.20892	+.21243	+.18859
	C	+.70711	+.45966	+.35894	+.29206	+.24146	+.19949	+.16194	+.08767	+.04905	+.03388	+.02275	+.01430
.906	P	-.55557	-.63795	-.64222	-.61883	-.57489	-.52388	-.46335	-.32152	+.11037	+.18044	+.19791	+.18066
	C	+.55557	+.41934	+.34200	+.28528	+.23971	+.20038	+.16528	+.10265	+.05040	+.03457	+.02315	+.01461
.938	P	-.39268	-.53083	-.56352	-.55926	-.53582	-.50235	-.45986	-.35999	+.03471	+.14566	+.18116	+.17108
	C	+.39268	+.37332	+.31884	+.27238	+.23282	+.19819	+.16754	+.11700	+.05165	+.03550	+.02369	+.01484
.969	P	-.19509	-.42654	-.48327	-.49651	-.48818	-.46843	-.43922	-.36255	-.05042	+.11054	+.16516	+.16025
	C	+.19509	+.32772	+.29373	+.25712	+.22403	+.19478	+.16883	+.12666	+.05278	+.03632	+.02412	+.01499
1.000	P	-0.00000	-.34267	-.41183	-.43633	-.43956	-.42851	-.40898	-.34835	-.12788	+.07916	+.15039	+.14918
	C	+0.00000	+.28797	+.27025	+.24207	+.21479	+.19014	+.16778	+.12953	+.05772	+.03676	+.02363	+.01508
1.031	P	+.19509	-.29095	-.37402	-.41052	-.42567	-.42887	-.42358	-.39364	-.29986	-.14716	-.04033	+.02866
	C	+.19509	+.26627	+.25029	+.22735	+.20432	+.18284	+.16283	+.12695	+.06720	+.03954	+.02396	+.01508
1.063	P	+.39268	-.19499	-.31731	-.36350	-.38399	-.39198	-.39139	-.37170	-.29268	-.17275	-.06206	+.02004
	C	+.39268	+.25733	+.23656	+.21533	+.19482	+.17550	+.15740	+.12481	+.07275	+.04247	+.02507	+.01512
1.094	P	+.55557	-.01455	-.25285	-.31433	-.34269	-.35657	-.36081	-.34995	-.28893	-.19043	-.02038	+.00878
	C	+.55557	+.23066	+.22448	+.20527	+.18647	+.16881	+.15232	+.12272	+.07588	+.04535	+.02655	+.01518
1.125	P	+.70711	+.29594	-.17450	-.26676	-.30311	-.32255	-.33105	-.32800	-.28204	-.20135	-.09688	-.00453
	C	+.70711	+.22934	+.21259	+.19565	+.17869	+.16264	+.14759	+.12054	+.07760	+.04801	+.02812	+.01523
1.156	P	+.83147	+.52911	+.11172	-.19870	-.25490	-.28531	-.29999	-.30543	-.27320	-.20677	-.10976	-.01919

1.188	C	+.83147	+.35587	+.21018	+.18733	+.17154	+.15678	+.14303	+.11820	+.07848	+.05018	+.02956	+.01541
	P	+.92388	+.67776	+.43352	+.03979	-.15201	-.23477	-.26106	-.27965	-.26250	-.20785	-.12035	-.03419
	C	+.92388	+.42764	+.27775	+.18884	+.17006	+.15338	+.13861	+.11570	+.07878	+.05182	+.03081	+.01573
1.219	P	+.98079	+.78484	+.59342	+.39137	+.06440	-.11845	-.20899	-.24620	-.24865	-.20513	-.12850	-.04857
	C	+.98079	+.48219	+.32719	+.24154	+.16864	+.14150	+.13462	+.11303	+.07860	+.05294	+.03186	+.01621
1.250	P	+.1.00000	+.84822	+.69265	+.52897	+.35147	+.10094	-.12169	-.20203	-.23193	-.19917	-.13410	-.06149
	C	+.1.00000	+.51797	+.36310	+.26891	+.19592	+.15590	+.13477	+.11220	+.07809	+.05360	+.03271	+.01679
1.281	P	+.98079	+.87241	+.75472	+.62951	+.50011	+.31371	+.12235	-.10859	-.20789	-.18914	-.13698	-.07236
	C	+.98079	+.53260	+.38504	+.29803	+.23945	+.18444	+.14130	+.11357	+.07733	+.05384	+.03335	+.01745
1.313	P	+.92388	+.35900	+.77393	+.67890	+.57661	+.47577	+.35567	+.01800	-.17907	-.17506	-.13643	-.08060
	C	+.92388	+.53174	+.39866	+.31738	+.25905	+.21214	+.17359	+.11317	+.07611	+.05369	+.03381	+.01813
1.344	P	+.83147	+.31243	+.75938	+.69206	+.61416	+.53169	+.43448	+.17292	-.15195	-.16085	-.13404	-.08612
	C	+.83147	+.51459	+.39926	+.32821	+.27277	+.22996	+.19249	+.11861	+.07568	+.05375	+.03427	+.01878
1.375	P	+.70711	+.73710	+.71467	+.67011	+.61254	+.54772	+.47356	+.30103	-.10289	-.13937	-.12896	-.08919
	C	+.70711	+.48369	+.38962	+.32596	+.27699	+.23572	+.19920	+.13249	+.07677	+.05433	+.03481	+.01939
1.406	P	+.55557	+.64975	+.64803	+.62627	+.58883	+.54325	+.48972	+.37060	-.02368	-.10662	-.11959	-.08938
	C	+.55557	+.44257	+.37107	+.31730	+.27366	+.23614	+.20320	+.14862	+.07836	+.05527	+.03546	+.01991
1.438	P	+.38268	+.53401	+.56979	+.56895	+.54934	+.51993	+.48208	+.39094	+.07732	-.06808	-.10834	-.08673
	C	+.38268	+.39614	+.34714	+.30379	+.26664	+.23439	+.20607	+.15992	+.08128	+.05614	+.03579	+.02031
1.469	P	+.19509	+.42998	+.48951	+.50558	+.50018	+.48336	+.45759	+.38668	+.16849	-.03001	-.09482	-.08229
	C	+.19509	+.35074	+.32200	+.28852	+.25774	+.23035	+.20572	+.16357	+.09892	+.05655	+.03493	+.02057
1.500	P	+.00000	+.34624	+.41788	+.44486	+.44975	+.44260	+.42662	+.37466	+.22237	+.00547	-.07661	-.07735
	C	+.00000	+.31156	+.29869	+.27324	+.24773	+.22418	+.20240	+.16366	+.09780	+.05644	+.03345	+.02070
1.531	P	+.19509	+.28325	+.36177	+.39401	+.40511	+.40455	+.39570	+.35905	+.24386	+.03829	-.05501	-.07272
	C	+.19509	+.29125	+.27981	+.25925	+.23766	+.21710	+.19769	+.16249	+.10399	+.05672	+.03270	+.02087
1.563	P	+.38268	+.18686	+.30584	+.34843	+.36555	+.37046	+.36689	+.34126	+.24821	+.06739	-.03303	-.06792
	C	+.38268	+.28391	+.26697	+.24782	+.22861	+.21018	+.19269	+.16072	+.10722	+.05749	+.03282	+.02112
1.594	P	+.55557	+.00425	+.24283	+.30078	+.32604	+.33707	+.33851	+.32179	+.24503	+.09184	-.01262	-.06241
	C	+.55557	+.25998	+.25593	+.23837	+.22071	+.20384	+.18785	+.15854	+.10843	+.05863	+.03356	+.02143
1.625	P	+.70711	+.30503	+.16191	+.25402	+.28772	+.30451	+.31026	+.30121	+.23854	+.11127	+.00538	-.05598
	C	+.70711	+.26473	+.24560	+.22951	+.21340	+.19793	+.18322	+.15602	+.10842	+.05998	+.03468	+.02178
1.656	P	+.83147	+.53178	+.13380	+.18689	+.24071	+.26847	+.28028	+.27954	+.23044	+.12580	+.02072	-.04869
	C	+.83147	+.38315	+.24498	+.22194	+.20672	+.19229	+.17863	+.15320	+.10768	+.06144	+.03600	+.02215
1.688	P	+.92388	+.68069	+.43954	+.07244	+.13291	+.21815	+.24166	+.25434	+.22103	+.13573	+.03345	-.04076
	C	+.92388	+.45070	+.31005	+.22467	+.20548	+.18881	+.17426	+.15011	+.10651	+.06287	+.03738	+.02252
1.719	P	+.98079	+.78713	+.59851	+.39918	+.09262	+.09256	+.19182	+.22238	+.20906	+.14110	+.04366	-.03247
	C	+.98079	+.50315	+.35611	+.27497	+.20503	+.17796	+.16989	+.14683	+.10504	+.06417	+.03869	+.02285
1.750	P	+.1.00000	+.84993	+.69720	+.53820	+.37097	-.12657	+.09334	+.17534	+.19449	+.14225	+.05140	-.02418
	C	+.1.00000	+.53769	+.38970	+.30058	+.23406	+.19402	+.17034	+.14572	+.10344	+.06526	+.03986	+.02313
1.781	P	+.98079	+.87419	+.75849	+.63573	+.50829	-.34044	-.16678	+.07742	+.17263	+.13811	+.05653	-.01621

1.813	C	+.99079	+.55193	+.41146	+.32890	+.27271	+.22083	+.17960	+.14664	+.10164	+.06602	+.04080	+.02334
	P	-.92388	-.86060	-.77756	-.68509	-.58599	-.48781	-.37277	-.05702	+.14794	+.12958	+.05867	+.00904
	C	+.92388	+.55076	+.42384	+.34630	+.29076	+.24674	+.21000	+.14693	+.09962	+.06650	+.04153	+.02345
1.844	P	-.83147	-.81391	-.76287	-.69665	-.62073	-.53985	-.44707	-.21357	+.11932	+.11873	+.05934	+.00285
	C	+.83147	+.53328	+.42380	+.35412	+.30283	+.26124	+.22483	+.15469	+.09934	+.06752	+.04229	+.02347
1.875	P	-.70711	-.73844	-.71748	-.67469	-.61942	-.55746	-.48754	-.33187	+.06083	+.09669	+.05664	+.00212
	C	+.70711	+.50217	+.41341	+.35267	+.30560	+.26581	+.23078	+.16909	+.10086	+.06913	+.04310	+.02338
1.906	P	-.55557	-.64223	-.65111	-.63120	-.59595	-.55284	-.50225	-.38996	-.03195	+.06204	+.04992	+.00515
	C	+.55557	+.46083	+.36435	+.34338	+.30177	+.26605	+.23483	+.18374	+.10314	+.07092	+.04385	+.02320
1.938	P	-.38268	-.53565	-.57294	-.57368	-.55574	-.52004	-.49218	-.40438	-.13910	+.02156	+.04055	+.00625
	C	+.38268	+.41459	+.37033	+.32971	+.29450	+.26378	+.23654	+.19077	+.10987	+.07238	+.04356	+.02287
1.969	P	-.19509	-.43168	-.49255	-.50999	-.50606	-.49083	-.46706	-.40080	-.21639	-.01938	+.02536	+.00637
	C	+.19509	+.36963	+.34527	+.31420	+.28498	+.25860	+.23455	+.19233	+.11933	+.07352	+.04254	+.02245
2.000	P	-.00000	-.34802	-.42093	-.44926	-.45566	-.45019	-.43619	-.38910	-.25395	-.05854	+.00452	+.00605
	C	+.00000	+.33101	+.32201	+.29858	+.27429	+.25148	+.23013	+.19157	+.12831	+.07526	+.04243	+.02220
2.031	P	+.19509	-.28419	-.36335	-.39626	-.40808	-.40831	-.40031	-.36563	-.25513	-.06643	+.01865	+.03976
	C	+.19509	+.31132	+.30325	+.28439	+.26392	+.24390	+.22488	+.18994	+.13060	+.07643	+.04269	+.02251
2.063	P	+.38268	-.18792	-.30744	-.35067	-.36846	-.37405	-.37120	-.34714	-.25779	-.05888	-.00293	+.03653
	C	+.38268	+.30494	+.29059	+.27285	+.25450	+.23661	+.21944	+.18758	+.13239	+.07793	+.04365	+.02293
2.094	P	+.55557	-.00567	-.24434	-.30293	-.32881	-.34046	-.34252	-.32721	-.25431	-.11961	-.02249	+.03165
	C	+.55557	+.28354	+.27997	+.26340	+.24642	+.22995	+.21418	+.18476	+.13258	+.07961	+.04505	+.02342
2.125	P	+.70711	+.30379	-.16389	-.25614	-.29038	-.30773	-.31408	-.30642	-.24801	-.13756	-.03942	+.02515
	C	+.70711	+.28754	+.27002	+.23462	+.23898	+.22377	+.20914	+.18164	+.13183	+.08135	+.04664	+.02392
2.156	P	+.83147	+.53138	+.13037	+.18994	-.24324	-.27156	-.28399	-.28470	-.24021	-.15015	-.05365	+.01727
	C	+.83147	+.40100	+.26909	+.24707	+.23216	+.21786	+.20417	+.17827	+.13057	+.08303	+.04826	+.02440
2.168	P	+.92388	+.69024	+.43860	+.06694	-.13630	-.22127	-.24539	-.25955	-.23098	-.15794	-.06536	+.00839
	C	+.92388	+.46682	+.33130	+.24931	+.23064	+.21410	+.19944	+.17470	+.12905	+.08456	+.04979	+.02480
2.219	P	+.98079	+.78676	+.59769	+.39787	+.08756	-.09738	-.19529	-.22752	-.21900	-.16111	-.07470	+.00113
	C	+.98079	+.51816	+.37596	+.29758	+.22987	+.20319	+.19470	+.17097	+.12732	+.08585	+.05114	+.02511
2.250	P	+.1.00000	+.84967	+.69639	+.53656	+.36756	+.12173	-.09910	-.18122	-.20424	-.16012	-.08174	+.01085
	C	+.1.00000	+.55198	+.40865	+.32217	+.25704	+.21796	+.19477	+.16947	+.12550	+.08666	+.05222	+.02552
2.281	P	+.98079	+.87387	+.75782	+.63459	+.50674	+.33537	+.15822	-.08436	-.18202	-.15402	-.08631	+.02020
	C	+.98079	+.56574	+.42951	+.34929	+.29465	+.24375	+.20305	+.17013	+.12349	+.09687	+.05299	+.02604
2.313	P	+.92388	+.86030	+.77687	+.68392	+.58423	+.48566	+.36961	+.04920	-.15648	-.14382	-.08787	+.02844
	C	+.92388	+.56417	+.44130	+.36598	+.31184	+.26869	+.23250	+.17001	+.12116	+.08660	+.05351	+.02664
2.344	P	+.83147	+.81363	+.76230	+.69575	+.61940	+.53813	+.44434	+.20465	-.12844	-.13160	-.08794	+.03521
	C	+.83147	+.54645	+.44079	+.37321	+.32328	+.28270	+.24693	+.17675	+.12051	+.08682	+.05411	+.02725
2.375	P	+.70711	+.73917	+.71690	+.67372	+.61793	+.55532	+.48446	+.32524	-.07227	-.10937	-.08473	+.04025
	C	+.70711	+.51522	+.43012	+.37138	+.32559	+.28667	+.25215	+.19012	+.12175	+.08769	+.05481	+.02783
2.406	P	+.55557	+.64191	+.65044	+.63013	+.59439	+.55075	+.49952	+.38594	+.01701	+.07496	+.07734	+.04287

3.063	C	+ .19509	+ .33621	+ .33228	+ .31558	+ .29637	+ .27737	+ .25896	+ .22486	+ .16339	+ .10627	+ .06483	+ .03648
	P	+ .38268	- .18827	- .30798	- .35142	- .36943	- .37524	- .37263	- .34908	- .26078	- .10170	- .00420	+ .04086
	C	+ .38268	+ .33104	+ .31998	+ .30408	+ .28693	+ .26989	+ .25331	+ .22244	+ .16467	+ .10727	+ .06511	+ .03672
3.094	P	+ .55557	- .00615	- .24484	- .30365	- .32974	- .34158	- .34385	- .32895	- .25698	- .12507	- .02393	+ .03531
	C	+ .55557	+ .31276	+ .31000	+ .29482	+ .27887	+ .26319	+ .24799	+ .21963	+ .16472	+ .10805	+ .06573	+ .03702
3.125	P	+ .70711	+ .30336	- .16454	- .25684	- .29125	- .30878	- .31531	- .30802	- .25053	- .14256	- .04095	+ .02813
	C	+ .70711	+ .31664	+ .30071	+ .28637	+ .27159	+ .25707	+ .24299	+ .21660	+ .16392	+ .10871	+ .06656	+ .03734
3.156	P	+ .83147	+ .53125	+ .12922	- .18961	- .24405	- .27253	- .28514	- .28621	- .24263	- .15466	- .05520	+ .01963
	C	+ .83147	+ .42373	+ .29975	+ .27912	+ .26496	+ .25130	+ .23815	+ .21339	+ .16260	+ .10935	+ .06750	+ .03766
3.188	P	+ .92388	+ .68008	+ .43829	+ .06515	- .13738	- .22222	- .24651	- .26100	- .23330	- .16196	- .06690	+ .01018
	C	+ .92388	+ .48728	+ .35859	+ .28110	+ .26340	+ .24764	+ .23359	+ .21004	+ .16097	+ .10994	+ .06847	+ .03795
3.219	P	+ .98079	+ .78663	+ .59742	+ .39745	+ .08598	- .09884	- .19627	- .22897	- .22119	- .16468	- .07621	+ .00018
	C	+ .98079	+ .53726	+ .40147	+ .32690	+ .26259	+ .23721	+ .22905	+ .20643	+ .15912	+ .11044	+ .06940	+ .03819
3.250	P	+ 1.00000	+ .84957	+ .69614	+ .53605	+ .36650	+ .12030	- .10072	- .18272	- .20631	- .16327	- .08322	- .00997
	C	+ 1.00000	+ .57029	+ .43312	+ .35052	+ .28828	+ .25110	+ .22909	+ .20425	+ .15714	+ .11077	+ .07024	+ .03843
3.281	P	+ .98079	+ .75761	+ .57561	+ .63425	+ .50628	+ .33390	+ .15578	- .08611	- .18395	- .15680	- .08776	- .01969
	C	+ .98079	+ .45328	+ .45328	+ .37655	+ .32436	+ .27571	+ .23675	+ .20431	+ .15495	+ .11076	+ .07089	+ .03874
3.313	P	+ .92388	+ .86021	+ .77667	+ .68358	+ .59372	+ .48502	+ .38871	+ .04601	- .15816	- .14603	- .08928	- .02825
	C	+ .92388	+ .58186	+ .46457	+ .39258	+ .34078	+ .29945	+ .26473	+ .20481	+ .15235	+ .11035	+ .07133	+ .03907
3.344	P	+ .83147	+ .31355	+ .76213	+ .69549	+ .61903	+ .53767	+ .44363	+ .20244	- .13022	- .13378	- .08931	- .03527
	C	+ .83147	+ .456405	+ .46375	+ .39932	+ .35159	+ .31274	+ .27836	+ .21122	+ .15104	+ .11016	+ .07181	+ .03941
3.375	P	+ .70711	+ .73809	+ .71674	+ .67346	+ .61755	+ .55478	+ .48369	+ .32360	- .07456	- .11152	- .08610	- .04051
	C	+ .70711	+ .53288	+ .45294	+ .39715	+ .35335	+ .31584	+ .28225	+ .22045	+ .15138	+ .11025	+ .07220	+ .03973
3.406	P	+ .55557	+ .64133	+ .65027	+ .62936	+ .59400	+ .55023	+ .49884	+ .38494	+ .01397	- .07714	- .07869	- .04327
	C	+ .55557	+ .49180	+ .43358	+ .38706	+ .34813	+ .31397	+ .28345	+ .23021	+ .15253	+ .11045	+ .07250	+ .03997
3.438	P	+ .38268	+ .53520	+ .57208	+ .57239	+ .55399	+ .52581	+ .48937	+ .40051	+ .12079	- .03712	- .06912	- .04359
	C	+ .38268	+ .44590	+ .40924	+ .37243	+ .33934	+ .30972	+ .28293	+ .23609	+ .15580	+ .11130	+ .07252	+ .04009
3.469	P	+ .19509	+ .43122	+ .49171	+ .50875	+ .50439	+ .48868	+ .46431	+ .39655	+ .20326	+ .00286	- .05475	- .04249
	C	+ .19509	+ .40153	+ .38395	+ .35615	+ .32873	+ .30335	+ .27978	+ .23746	+ .16185	+ .11201	+ .07185	+ .04007
3.500	P	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .24520	+ .04110	- .03465	- .04107
	C	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .16751	+ .11282	+ .07106	+ .04006
3.531	P	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .26004	+ .07569	- .01219	- .03639
	C	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .17094	+ .11583	+ .07061	+ .04019
3.563	P	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .26184	+ .10493	+ .00970	- .03339
	C	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .17245	+ .11799	+ .07109	+ .04038
3.594	P	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .25804	+ .12616	+ .02931	- .02739
	C	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .17266	+ .11762	+ .07165	+ .04061
3.625	P	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .25164	+ .14549	+ .04619	- .02249
	C	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .17199	+ .11830	+ .07269	+ .04079
3.656	P	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .24377	+ .14549	+ .04619	- .02249
	C	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .00000	+ .17199	+ .11830	+ .07269	+ .04079

SAND CONCENTRATION LARGE GRID

CONCENTRATION AS FUNCTION OF TIME FOR VARIOUS LEVELS

1 POSITION REPRESENTS $\pm 454371-01$
1 LINE REPRESENTS $\pm 176141-01$

SAND CONCENTRATION NEAR THE BOTTOM

1 POSITION REPRESENTS :+.479131-01
1 LINE REPRESENTS :+.176141-01

CONCENTRATION AS FUNCTION OF TIME FOR VARIOUS LEVELS
CURVE = 1 2 3 4 5 6 7
LEVEL = .000 .031 .063 .094 .125 .156 .188
 $Y/KAPPA(U(LINF)/T)/SQRT(FWZ)$