AR3AE015  AE_Studio
Name: Yuxiao He / Student.Number: 4227107

Tutors:
Tjalling Homans
Engbert van der Zaag
Martijn Stellingwerff
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01 Overall Design Question
a. Problem statement
Overall Design Question - Technical Research - Architectural Design

a. Problem statement
a. Problem statement
a. Problem statement
a. Problem statement
Overall Design Question: Technical Research - Architectural Design

a. Problem statement
b. Technical fascination
b. Technical fascination
b. Technical fascination

Overall Design Question - Technical Research - Architectural Design

Digital Design & Workflow
c. Overall design question

How can I design a cultural complex in extension of Westerpark by digital design and workflow?
02 Technical Research
a. method

Literature
a. method

Literature

+ Digital skills & tools
a. method

Literature
+
Digital skills & tools
+
Hypothetical design
Overall Design Question - Technical Research - Architectural Design

a. Method

- freeform surface:

a. freeform basics

Understanding smooth freeform surfaces largely depends on the knowledge of freeform curves, the former one can be simply interpreted as a two-dimensional version of the latter one. All properties of freeform curves are retained in corresponding surfaces, control points work in two directions, namely u and v direction, the control polygon line become a conjugate polygon network. Smooth surface types are able to be referred to its constructive curve types respectively, namely Bezier surface, B-spline surface and NURBS surface (Figure 5.7).

Note that the 3 types of smooth surfaces have severe restrictions in terms of topological process, but this weakness can be overcome by approximation of mesh polygon, I will discuss mesh in further details in Chapter 02.

![Figure 5.7 (AG p.377)](image)

b. parametric representation

The correspondence between freeform curves and surfaces with regard to control points is also valid for parametric representation. The only variable $t$ in curves is replaced by variables $u$ and $v$ in corresponding two directions, therefore a parameterized surface $s$ can be represented by an equation $s(u,v) = (x(u,v), y(u,v), z(u,v))$. Variables $u$ and $v$ are bounded in two intervals accordingly, consequently these two intervals map a two-dimensional region $R$, we name this space as $R_2$. In contrast with $R_2$, the real three-dimensional Euclidean space is named as $R_3$, logically parameterized curve as $R_1$. The transition and communication between $R_1$, $R_2$ and $R_3$ is essential for understanding complex geometries as well as processing them (Figure 5.8).

![Figure 5.8 (AG p.217)](image)
Appendix 01. Detecting features on freeform surface

```c
// Algorithm for detecting features on freeform surfaces
// Version 01

overallDesignQuestion - technicalResearch - architecturalDesign

a. Method
```

---

**Overall Design Question - Technical Research - Architectural Design**

**Appendix 01. Detecting features on freeform surface**

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overallDesignQuestion - technicalResearch - architecturalDesign

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// Version 01

overallDesignQuestion - technicalResearch - architecturalDesign

a. Method
```
c). Hypothetical Design

1). Discretization for all base surface pieces

All pieces of base surface experiences the discretization process researched in Chapter 0.2 (Figure 5.3).

Figure 5.22
1. base surface gained in Part II; 2. Initially quadedral mesh generated from base surfaces; 3. During mesh relaxation process, all boundary vertices marked in red, dots are kept, anchor points to keep all pieces of surfaces aligning with each other, while all direct vertices marked in black dot are able to move freely at their specific levels; 4. all vertices after mesh relaxation of mean spring system, color gives relevant architectural requirements; 5. new quadedral mesh created from vertices after relaxation; 6. new linked smooth surfaces created from vertices after relaxation; 7. sample points after feature detection, cyan indicates corner points; magenta indicates corner points; 8. final tri mesh after conversion from quad mesh.
Overall Design Question - Technical Research - Architectural Design

a. Method
a. Method
03 Architectural Design
a. method

Bottom-up
+ 
Top-down
b. Context Research
b. Context Research
b. Context Research
b. Context Research

Key words:
Smallness & Diversity
Overall Design Question - Technical Research - Architectural Design

3. Going Out
- 1 TV Programme
- 1 Cinema
- 1 Theatre
- 1 Outdoor Dancing
- 1 Art Studio
- 1 Night Club

2. Shops & Galleries
- 1 Gallery
- 1 Shop
- 2 Mix of shopping and exhibition

1. Restaurants & Bars
- 1 Bakery
- 3 Cafe
- 6 Restaurants

4. Organizations
- 1 Park Management
- 1 Food Research
- 2 Education
- 2 Specialist Club
- 3 Media
- 11 Consulting Firms

Statistic of Permanent Tenants

Totally 13 Venues Can be Rent out Independently
b. Context Research

Key words:
Cooperation & Flexibility
b. Context Research

Key words:
Smallness & Diversity
Cooperation & Flexibility
b. Context Research

Key words:
Smallness & Diversity
Cooperation & Flexibility

Keep that in mind !!
c. Extension planning
c. Extension planning

Guests behavior Simulation System

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</tbody>
</table>
c. Extension planning

Video
c. Extension planning
c. Extension planning
c. Extension planning
c. Extension planning
c. Extension planning
c. Extension planning
c. Extension planning
c. Extension planning

Overall Design Question - Technical Research - Architectural Design

LBA: In-Between Area:
1. for future buildings
2. for public infrastructure
c. Extension planning

LBA: In-Between Area:
1. for future buildings
2. for public infrastructure

- Landscape Garden
- Artists Village
- Central Plaza
- Sculpture Garden
- Water Garden
- Culture Complex
- Axis-a
d. Program
d. Program

- Gallaries: 3000 m²
- Offices: 900 m²
- Restaurant: 1000 m²
d. Program

Central Plaza

- 1000 m²
- 900 m²

Water Garden

- 3000 m²

Sculpture Garden

900 m²

1000 m²

3000 m²
d. Program
d. Program
d. Program
d. Program
d. Program
Overall Design Question - Technical Research - Architectural Design

d. Program
d. Program
Overall Design Question - Technical Research - Architectural Design

d. Program
d. Program
d. Program
Overall Design Question - Technical Research - Architectural Design

d. Program
d. Program

- Under Railway Creative Space
- Central Plaza
- Water Garden
- Sculpture Garden
d. Program

Overall Design Question - Technical Research - Architectural Design
d. Program

Key words:
Smallness & Diversity
Cooperation & Flexibility
d. Program

Overall Design Question - Technical Research - Architectural Design

Art Market
d. Program

Art Market
d. Program

Overall Design Question - Technical Research - Architectural Design

Art Market
Overall Design Question - Technical Research - Architectural Design

d. Program

Art Market
d. Program

Infor Center
d. Program

Info desk
Overall Design Question - Technical Research - Architectural Design

d. Program

Cafe
Public Arts Museum
d. Program

Auditorium
d. Program

Auditorium
d. Program

Auditorium
d. Program

Auditorium
d. Program

Auditorium
d. Program

Key words:
Smallness & Diversity
Cooperation & Flexibility
Overall Design Question - Technical Research - Architectural Design

d. Program

First floor
d. Program

Overall Design Question - Technical Research - Architectural Design

Second floor
d. Program

Section north-south
d. Program

Top view
d. Program

Restaurant
d. Program

The Hall
Overall Design Question - Technical Research - Architectural Design

d. Program

Public Arts Museum
e. Structure
Ground
d. Structure

Interior canal glazing
d. Structure

Ground floor load-bearing structure
d. Structure

First floor slabs
d. Structure

First floor load-bearing structure
d. Structure

Second floor slabs
d. Structure

Second floor load-bearing structure
d. Structure

Primary load-bearing trusses of roof
d. Structure

Secondary spatial trusses
d. Structure

Straight steel girders
d. Structure

3 Bridges in the hall & shortcuts
d. Structure

Interior finishes
d. Structure

Exterior finishes
d. Structure

Grand ceiling finishes
Steel lattice columns in the museum
d. Structure

Glazed functioning as elevators
d. Structure

3 Bridges
d. Structure

3 Bridges
d. Structure

3 Bridges
d. Structure

3 Bridges
d. Structure

Bridge Section
f. Climate
f. Climate

HVAC Departments
f. Climate

HVAC Departments

Centralized Air Handling Unit

1 2 3 4 5

HVAC Systems
Winter heating

- Winter heating system
- Heat recovery device
- Pre-heating
- Waste air
- Cold air
- Fresh air
- Boiler
- Pump
- Fan
- Filter
- Humidifier
- Heat exchanger
f. Climate

Summer Cooling

- Heat recovery device
- Pre-cooling
- Waste air
- Hot
- Fresh air
- Heat exchange
- Canal
- Water 2°C
- Pump
- Filter
- Dehumidifier
f. Climate

Ventilation in details
g. Facade
g. Facade

Building axes
g. Facade

Cladding axes
g. Facade

Cladding differentiation
g. Facade

Cladding setout
g. Facade

Facade level heights setting
g. Facade

All cladding panels
g. Facade

East Elevation
Overall Design Question - Technical Research - Architectural Design

g. Facade

North Elevation
g. Facade
g. Facade

Facade Material: Aluminum Panel
g. Facade
Section Facade Material: Streched metal mesh
Impression Collage
g. Facade

3 Strips types
g. Facade

3 Strips types
g. Facade

3 Strips types
g. Facade

*One case of caculation*
g. Facade

One case of calculation
g. Facade

One case of caculation
g. Facade

2D

3D

One case of calculation
g. Facade

One case of calculation
g. Facade

One case of caculation
g. Facade

One case of calculation

Overall Design Question - Technical Research - Architectural Design
g. Facade

One case of calculation
One case of calculation

4050 = h1 + h2 + h3
g. Facade

One case of calculation

\[ h_1 = d \times \left( \frac{1}{\sin(a)} - \cot(a) \right) \]
\[ h_3 = 1200 \times \left( \frac{1}{\sin(a)} - \cot(a) \right) \]
\[ h_2 = (2400 + 3d) \times \tan(a) \]

\[ 4050 = h_1 + h_2 + h_3 \]

One case of calculation
g. Facade

\[ h_1 = d \times (\frac{1}{\sin(a)} - \cot(a)) \]
\[ h_2 = (2400 + 3d) \times \tan(a) \]
\[ h_3 = 1200 \times (\frac{1}{\sin(a)} - \cot(a)) \]

\[ 4050 = h_1 + h_2 + h_3 \]

One case of calculation
g. Facade

One case of calculation

\[
\begin{align*}
4050 &= h_1 + h_2 + h_3 \\
4050 &= (1200 + d) \times (1/\sin(a) - \cot(a)) + (2400 + 3\times d) \times \tan(a) \\
\end{align*}
\]

\[
\begin{align*}
h_1 &= d \times (1/\sin(a) - \cot(a)) \\
h_2 &= (2400 + 3\times d) \times \tan(a) \\
h_3 &= 1200 \times (1/\sin(a) - \cot(a)) \\
\end{align*}
\]

\[
a \approx 2. (3.14159 \times 1.08867); \quad n \text{ element } Z
\]
Overall Design Question - Technical Research - Architectural Design

### g. Facade

One case of calculation

\[ h_1 = d \times \left(\frac{1}{\sin(a)} - \cot(a)\right) \]
\[ h_2 = (2400 + 3d) \times \tan(a) \]
\[ h_3 = 1200 \times \left(\frac{1}{\sin(a)} - \cot(a)\right) \]

\[ 4050 = h_1 + h_2 + h_3 \]
\[ 4050 = (1200 + d) \times \left(\frac{1}{\sin(a)} - \cot(a)\right) + (2400 + 3d) \times \tan(a) \]

\[ a = x \approx 2.3.14159 \times 1.08867; \quad n \in \mathbb{Z} \]

\[ r_1, r_2, r_3 \]

\[ d \approx 1194.944811 \]
g. Facade

Overall Design Question - Technical Research - Architectural Design

\[ h_1 = d \cdot (1 / \sin(a) - \cot(a)) \]
\[ h_2 = (2400 + 3d) \cdot \tan(a) \]
\[ h_3 = 1200 \cdot (1 / \sin(a) - \cot(a)) \]

4050 = h_1 + h_2 + h_3

4050 = (1200 + d) \cdot (1 / \sin(a) - \cot(a)) + (2400 + 3d) \cdot \tan(a)

\[ a = x \approx 2 \cdot (3.14159 - 1.08867); \ n \text{ element } Z \]

One case of caculation
9 Types of panels
g. Facade

#: Type number
A: Planarity
B: Dimension variation
C: Edge geometry type

#_A_B_C
g. Facade

01_Flat_Constant_Rectangular

number: x971
g. Facade

02.Flat_Varying_Trapzoid
number: x895
g. Facade

03_Flat_Constant_Arc

number: x63
g. Facade

04_Arc-curved_Constant_Arc
number: x42
g. Facade

05_Flat_Varying_Arc

number: x19
g. Facade

06_Single-curved_Constant_Bishop-curve
number: x3
Overall Design Question - Technical Research - Architectural Design

Facade

07_Arc-curved_Varying_Helix-curve

number: x100
g. Facade

08_Arc-curved_Varying_Bishop-curve

number: x11
g. Facade

09_Flat_Freeform_Line
number: x121
g. Facade

Concrete + Steel
g. Facade

Secondary beams
g. Facade

Supporting components
g. Facade

Supporting frameworks
g. Facade

Interior finishes
g. Facade

Insulation layer
g. Facade

Glazing
g. Facade

Water proof
g. Facade

Exterior cladding
g. Facade

Extra framework
g. Facade

Corner cladding
g. Facade

Overall Design Question - Technical Research - Architectural Design

Aluminum panel with metal substructure

Stretched mesh metal

Continuous slot

Fragment Plan

Detail 01
g. Facade

Supporting structure

Interior finish  exterior cladding

Cladding supporting component principal
g. Facade

Cladding supporting component principal
g. Facade

Supporting structure

Interior finish

exterior cladding

Cladding supporting component principal
g. Facade

Cladding Assembly
g. Facade

Cladding Assembly
g. Facade

Cladding Assembly
g. Facade

Cladding Assembly
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Cladding Assembly
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g. Facade

Cladding Assembly
g. Facade

Cladding Assembly
g. Facade

Fragment
g. Facade
g. Facade
g. Facade

- White Plaster
- Plywood sheet
- Motorized ventilation slot
- Motorized curtain

Details
g. Facade

Details

- Lightweight concrete, polished
- Cast-in embed
- Rainwater gutter
Thank you !