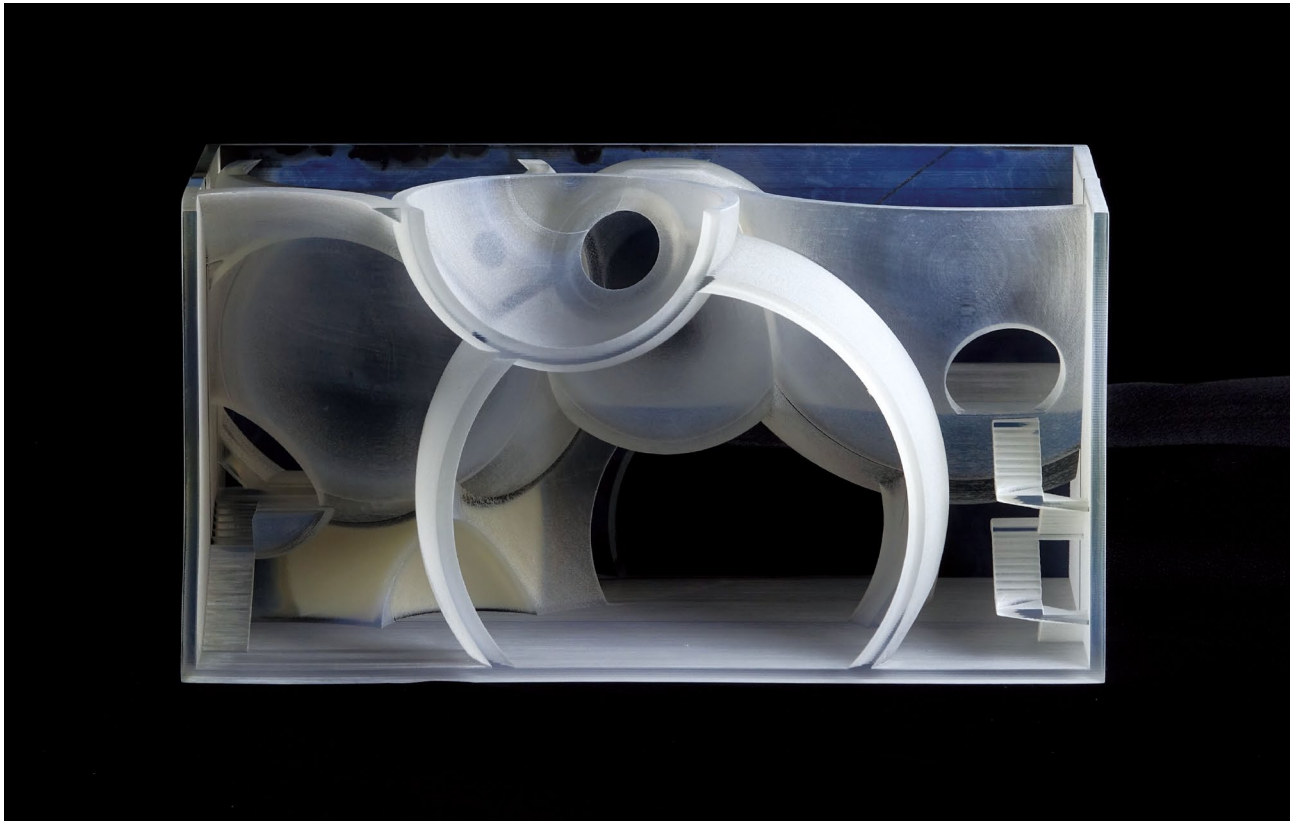
Design by Spheres – A Project for Museum

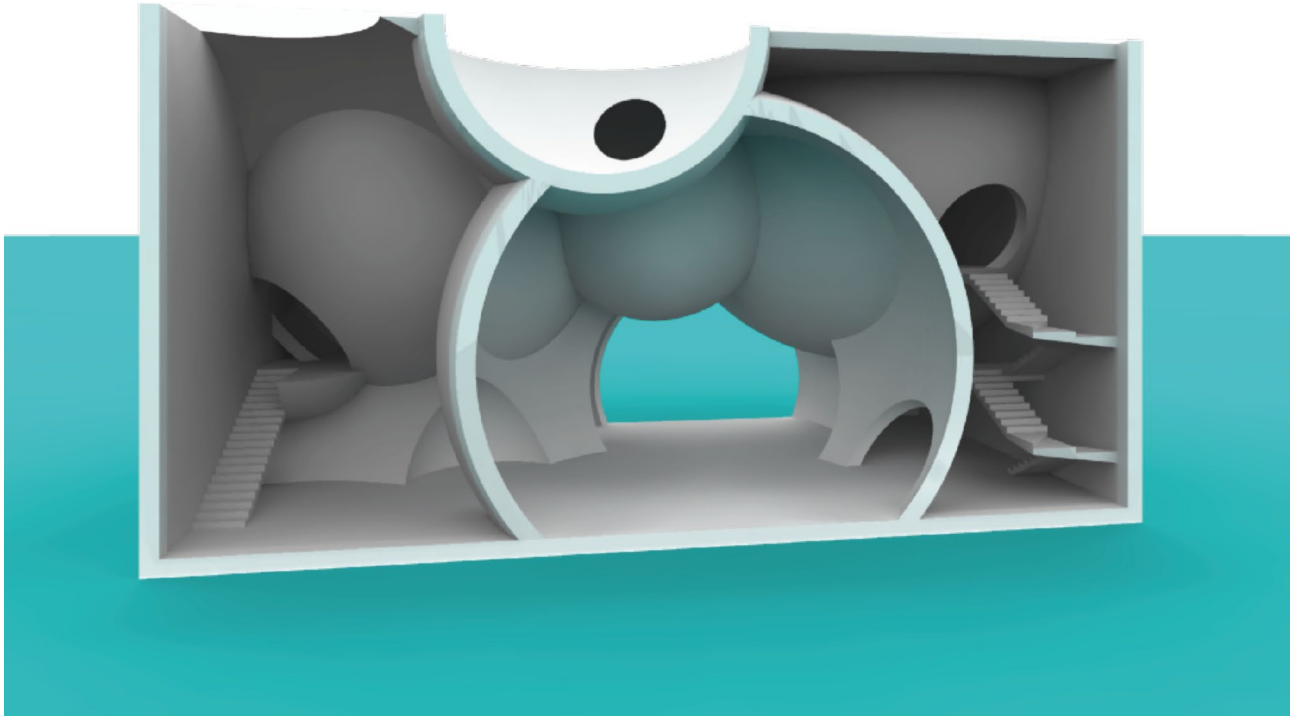
Naomi Ando



Naomi Ando “Design by Spheres – A Project for Museum” 2017, Material: VeroClear, Size: 180W x 90D x 93H (mm)

“Design by Spheres – A Project for Museum” is a prototype of a small museum. A total of 12 spheres of varied diameters from 3.2 m to 16 m were arranged inside a volume space that was 24 m wide, 12 m deep, and 12 m high. Dynamic spaces with spatial fluctuations were realized by the algorithm to generate spheres with random diameters in random positions. Individual functions, such as an entrance hall, a lobby, exhibition halls, a terrace, and storages, were given to each sphere, and architectural elements such as stairways and floors were added. The structure of this museum was assumed to be constructed with reinforced concrete shells of 20 cm to 40 cm thick.

Keywords: Sphere, Architecture, Algorithmic Design



1 Design by Spheres

Spheres, with centripetal spaces inside, have been used as a motif in various architectural designs, from the Pantheon (ancient Roman architecture) to modern architecture. “Design by Spheres – A Project for Museum” is a prototype of a small museum.

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2 Production Process

Besides the random values for the diameter and positions of

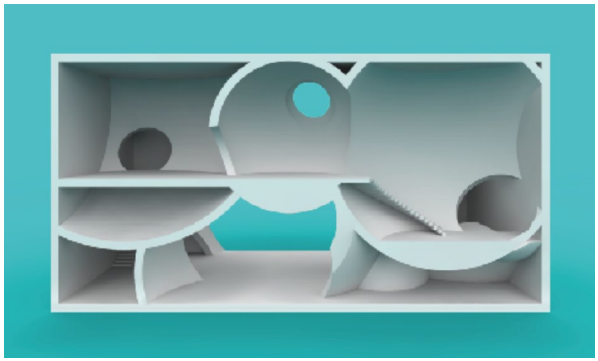

Figure 1: Section of Exhibition Halls

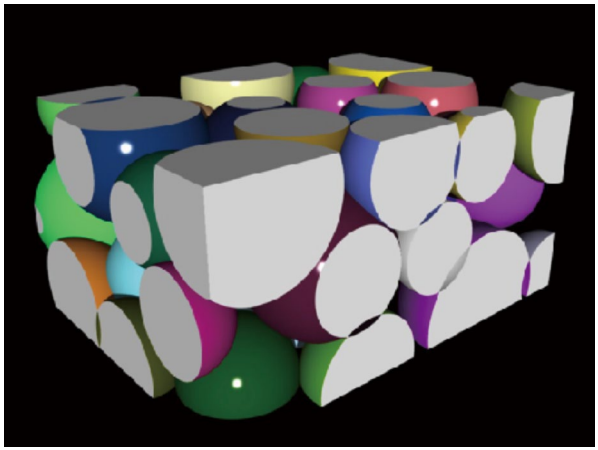

Figure 2: Arrangement of Spheres

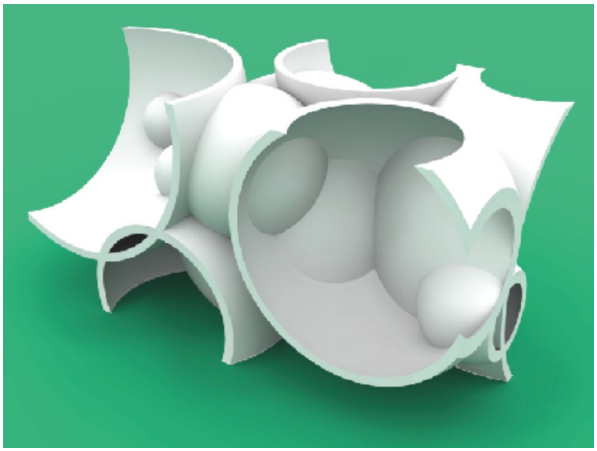

Figure 3: Framework

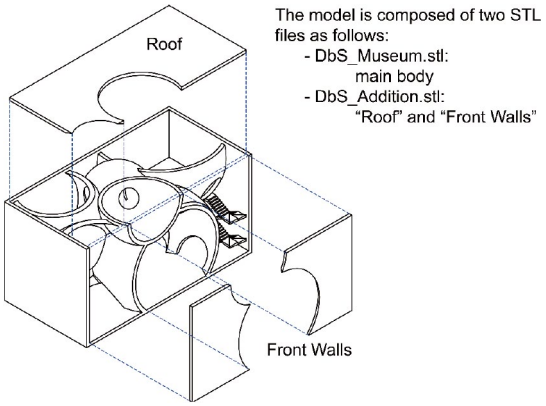

Figure 4: Exploded Diagram

the generated spheres, tangency or overlapping of spheres was controlled, as shown in Figure 2. The algorithm was described by VB (Visual Basic) component of Grasshopper(1), which is a plug-in for Rhinoceros(2). By this method, spheres were arranged randomly with the following conditions: [N] number of spheres were generated; the center points were in the [X-Y- Z] region; the radius of the spheres varied from [R0] to [R0+R1]; overlapping of the spheres was allowed if it was smaller than [B]. This method of the "Design by Spheres" was firstly presented at AFGS 2015[1].

Through a number of trials and errors in the automatic gener-

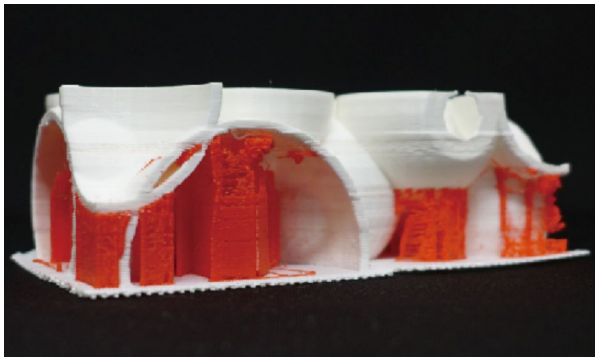

Figure 5: Trial Model (support materials are not removed)

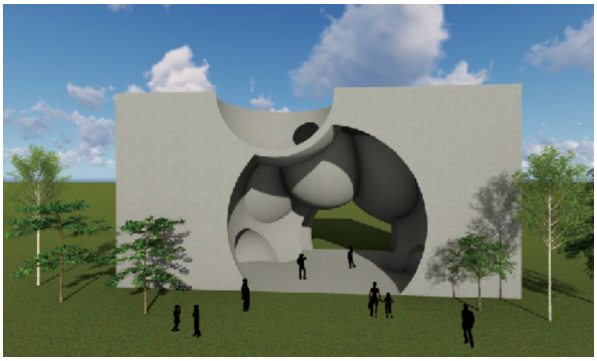

Figure 6: Exterior View

Figure 7: Interior Views of the Exhibition Halls

ations, a framework of the model, as shown in Figures 3 and 4, was determined. Trial model was fabricated by 3D printer, as shown is Figure 5. Then, some modifications for the structural rationality and planning efficiency were added for architectural design, as shown in Figures 6 and 7.

3 Software & System

(1) Rhinoceros: http://www.rhino3d.com/

(2) Grasshopper: http://www.grasshopper3d.com/

References

[1] Ando, N. Ishii, S., “Design by Spheres - A Computer Graphic Material for Architectural Design Education”, Proceedings of the Asian Forum on Graphic Science, P.8 (USB), 2015.