様式例：課程博士用

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論 文 要 旨(博士)

論文題目	Buckling Analysis of Two-Way Single Layer Lattice Dome with Nodal Eccentricity (節点で偏心接合された直交単層ラチスドームの座屈解析)

(要旨 1,200字程度)

Nowadays, double layer steel lattice roofs have been successfully applied to large span structures. Some of them have adopted a steel two-way network to support a membrane roof above themselves. The two-way system is attractive to architects and engineers since such a system is beautiful in shape, light in weight and systematic in construction. For introducing tensions by cables or slender bars into the membranes, an amount of different height has been prepared using some kind of struts or bracing elements above or within the roofs.

In this research, a new type of two-way single layer dome is introduced. This dome is composed of two main arches, intersecting each other with T-joint struts for providing space for tensioning membranes, like the double layer structures. The global form is simple, and the T-joint struts are assumed to connect the orthogonal main arches and no diagonal bracing elements are adopted by this system.

This research is generally aimed to investigate the buckling behavior of the proposed model of dome. To achieve this purpose, several parts of research are introduced with special purposes as follows; first, to study the rigidity and mechanical strengths of tubular T-joints connected using welded part under monotonic loading, second, to study a feasibility of two-way single layer latticed dome with nodal eccentricity under increasing vertical loads and repeated vertical loads and the last, to study buckling behavior of two-way single layer lattice dome with nodal eccentricity.

For the first part of research, rigidity and mechanical strengths of the tubular T-joints are determined using application of 3D Finite Element Analysis. To validate the results, the related experiments and design equations from AIJ recommendation are used. Then, because of the proposed model later is modeled by space frame analysis, rigidities and strengths of the joints needs to be approached for then applied at the joints of space frame model. For this purpose, tri-linear model is selected, and its application to the joints of space frame model is represented by superposition of two-bilinear springs. Based on the elasto-plastic analysis, firstly, the feasibility of the domes can be determined based on comparison of the numerical design loads and the practical ones. Next, the analysis is aimed to investigate the buckling behavior of the domes under increasing monotonic loading and repeated loading. The last, for the practical design, the procedure how to evaluate the buckling strength of the dome using concept of column buckling is introduced.

As the general result, the proposed domes can be possible to be applied as the one type of the spatial roof structures because of their good performances under static snow load. The remarkable feature found is its self recovery system for displacements since large displacements occurred due to heavy snow loads almost vanish after unloading. The reason of this recovery is the fact that most of the deformations attribute to elastic strains in the structures. And once an overload is given, some parts at the ends of strut members are deformed plastically without any damage to main arches. This system may be one kind of self-recovery structural system, and the plastic deformation will be effective to absorb energy due to strong disturbance, for example, from fluctuating wind loads or dynamic seismic loads, although such proof studies are required in near future.