Elastic buckling behavior of anisotropic latticed shells

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Abstract

In design of single layer lattice shells, it is critical to consider buckling. Many studies on buckling of single layer lattice shells have been done, so we can design latticed shells based on guidelines[1] in Japan. However, in most of these studies, isotropic latticed shells having the grid such as equilateral triangle or regular hexagon has been assumed. [1] There are few studies evaluating buckling behaver of anisotropic latticed shells.

In this study, we assumed latticed shells having grid of hexagon, rhombus and triangle with parametrically values of diagonal angle α to x axis. (Figure1) Firstly, we conducted the linear FE buckling analysis and the geometric nonlinear analysis on anisotropic latticed shells and investigated the knockdown factor defined as the ratio of the elastic buckling load p_{cr}^{el} to the linear buckling load p_{cr}^{lin}.The knockdown factor of the latticed shells having equal effective rigidities in the x-axis direction and the y-axis direction is low.However, the knockdown factor of the latticed shells with anisotropy is a slightly lower than one. (Figure2, *δ/span*=0)

Secondly, We estimated the lower limit of the elastic buckling load of the anisotropic latticed shells using the Reduced Stiffness method (RS).In the triangular latticed shells, the RS buckling load corresponding to the higher buckling mode is the minimum value. In the rhomboid and anisotropic hexagonal latticed shells, the RS buckling load corresponding to the 1st buckling mode is the minimum value. In addition, we investigated the knockdown fucter of anisotropic lattice shells while imperfection proportionaly to the RS buckling mode with the smallest RS value. From the analysis, the influence of the imperfection amplitude δ on the elastic buckling load varies depending on the lattice shape. (Figure 2)

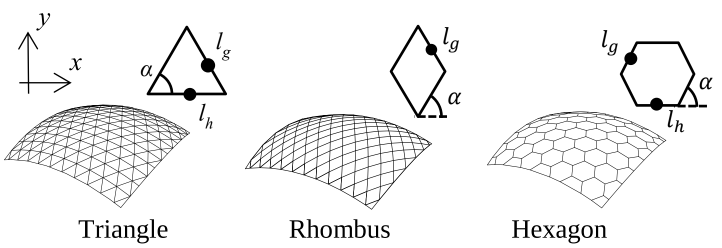

Figure1 Some examples of latticed shell

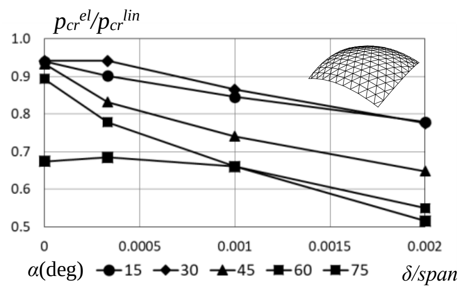

Figure2 The knockdown factors of triangular latticed shells

References

[1] Architectural Institute of Japan (AIJ): Recommendation for Design of Connections in Steel Structures, 2016 (in Japanese)