 ICCES, vol.19, no.1, pp.27-27

Path-Tracing Analysis of Axially Compressed Elastic Cylindrical Shells

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Summary

In designing a modern lightweight structure, the determination of the critical buckling load in an ideal condition is not sufficient. Clarifying the postbuckling behavior is also required. One reason is to estimate the effect of practically unavoidable imperfections on the critical load and another reason is to evaluate the ultimate load-carrying capacity of the structure. For the buckling problem of circular cylindrical shells under axial compression, experimental results showed that after the primary buckling, the secondary buckling occurred accompanied by successive reductions in the number of the circumferential waves at every path-jumping. In this paper, we traced this successive buckling of the circular cylindrical shells using the latest general-purpose FEM technology with a static stabilizing method. This method applies the artificial damping to overcome the analytical instability due to the local buckling. The study accomplished a fully automatic and seamless simulation of the successive path- jumping in the deep postbuckling region and showed good agreement with Yamaki's experimental results and Esslinger's high-speed photography.