THE INFLUENCE OF IMPERFECTIONS ON THE BEHAVIOUR OF SHALLOW SINGLE LAYER LATTICE DOMES

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Abstract

Initial geometric imperfections and small loads applied laterally to the members of space frames can have similar and significant effects on the behaviour of such structures. In particular, their presence in shallow, single layer, lattice domes has been shown to lead to considerable reductions in the stiffness and the strength of the domes.

An analytical model is presented, that enables the effects of geometric imperfections and lateral loads to be directly incorporated in the equilibrium equations that describe the spatial behaviour of beam-columns, and then by differentiating these equations with respect to deformations, in the derived expressions for their stiffness.

The new analytical model obtained, has been incorporated in an already available computer program for the geometrically nonlinear analysis of space frames. This program us is used in this thesis to analyse some standard problems and to reproduce solutions found in the literature or obtained with alternative methods.

The results of a series of tests, conducted on shallow, single layer, lattice domes containing members with geometric imperfections or lateral loading are reported. The modified computer program was used for the analysis of these test structures, and the computer predictions are presented along with the corresponding experimental observations.