

Effects of Opening Arrangement of Concrete Hemispherical Shells Reinforced with Carbon Fiber Chips on Cracking Pattern

by

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Abstract

The main purpose of this study is to investigate the effects of shell openings on the strength and failure patterns of concrete hemispherical shells reinforced with carbon fiber chips. As the variable parameters the of shell openings, the number of openings and their locations were adopted. Openings have been designed by prominent architects in concrete shell structures, because openings on the shell surface could introduce light into the inner space and could brighten the interior space. Carbon fiber chip reinforcement could realize high homogeneity of the concrete property and present a smooth construction process without ordinary steel bar reinforcement. As for the shell strength and cracking pattern, the effects of differences by the inclination of a connecting line between the central point on the horizontally projected surface and the central point in the openings from the grand line, the difference in the number of openings and the difference in the arrangement of the openings on the horizontally projected surface, were investigated, both experimentally and numerically, in this study. The failure experiment was conducted on concrete small-scaled shell specimens reinforced with carbon fiber chips, which were loaded perpendicularly with point load up to the failure state. The nonlinear numerical analysis involving irregularly variable thicknesses corresponding to the experimental specimens was adopted. The results were discussed on the bases of the results of the experiment and numerical analysis.

Keywords: Hemispherical Shell, Concrete Shell, Opening

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