Strength of Concrete Cylindrical Shells Reinforced with Complex Carbon Fiber under Static Load

by

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Abstract

The main purpose of this study is to investigate, both experimentally and theoretically, the strength of concrete cylindrical shells with complex carbon fiber reinforcement under static load. It is defined in this study that complex carbon fiber reinforcement consists of carbon fiber chips and carbon fiber sheets. The chips and the sheets could improve the tensile strength of a concrete shell in its internal and external regions, respectively. The effects of the area attached to a shell surface with carbon fiber sheet reinforcement on shell strength were also investigated. An experimental study was conducted on concrete shells reinforced with carbon fiber sheets on their top or bottom surfaces. Point load was applied perpendicularly on the shell surface to the final failure state. A theoretical study was conducted by material and geometrical nonlinear finite element analyses including tension cutoff and tension stiffening effects. The concrete shell strength was significantly influenced by the accuracy of the actual thickness so that nonlinear numerical calculations including discrete shell thickness variances were adopted. The ultimate strength with carbon fiber sheet reinforcement was discussed on the basis of the results of the failure experiments and nonlinear analyses.

Keywords: Concrete Shell, Carbon Fiber Chip, Carbon Fiber Sheet

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