

Failure Pattern of Concrete Cylindrical Shells Reinforced with Complex Carbon Fiber under Impact Load

by

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Abstract

The main purpose of this study is to investigate, both experimentally and numerically, the mechanical behaviors of concrete circular cylindrical shells reinforced with complex carbon fiber under impact point load. Complex carbon fiber reinforcement is defined in this study as combined reinforcement with carbon fiber sheets attached to the outer shell surface and with carbon fiber chips mixed into the inner shell body. Combined reinforcement could be expected to improve the quality of the shells, that is, the homogeneity and isotropy of the concrete shells with carbon fiber chips as compared to those with standard steel bars could be improved, while the mechanical behavior despite large thickness variances could be improved by carbon fiber sheets. A failure experimental study was conducted on two different types of reinforcement on small-scaled shell specimens attached to carbon fiber sheets. One type was made of a concrete shell reinforced with carbon fiber chips and the other type was made of a concrete reinforced shell with ordinary steel bars. Each model was applied with impact load up to failure states. As for numerical analysis, numerical calculations were carried out by a nonlinear transient dynamic finite element method. The effects of complex carbon fiber on the dynamic behaviors of concrete shells were discussed on the basis of the experimental and numerical results.

Keywords: Concrete Shell, Impact Load, Complex Carbon Fiber

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