Optimum Design of Dual-Purpose Outriggers in Tall Buildings

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Abstract : In this study, outriggers, which are horizontal structures connecting a building core to distant columns to increase the lateral stiffness of a tall building, are used to reduce differential axial shortening in a tall building. Therefore, the outriggers in tall buildings are used to serve the dual purposes of reducing the lateral displacement and reducing the differential axial shortening. Since the location of the outrigger greatly affects the effectiveness of the outrigger in terms of the lateral displacement at the top of the tall building and the maximum differential axial shortening, the optimum locations of the dual-purpose outriggers can be determined by an optimization method. Because the floors where the outriggers are installed are given as integer numbers, the conventional gradient-based optimization methods cannot be directly used. In this study, a piecewise quadratic interpolation method is used to resolve the integrality requirement posed by the optimum locations of the dual-purpose outriggers. The optimal solutions for the dual-purpose outriggers are searched by linear scalarization which is a popular method for multi-objective optimization problems. It was found that increasing the number of outriggers reduced the maximum lateral displacement and the maximum differential axial shortening. It was also noted that the optimum locations for reducing the lateral displacement and reducing the differential axial shortening were different. Acknowledgment: This research was supported by Basic Science Research Program through the National Research Foundation of Korea(NRF) funded by the Ministry of Science and ICT (NRF-2017R1A2B4010043) and financially supported by Korea Ministry of Land, Infrastructure and Transport(MOLIT) as U-City Master and Doctor Course Grant Program.

Keywords : concrete structure, optimization, outrigger, tall building

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