OPTIMAL DESIGN OF A LOW-RISE STRUCTURE IN A WIND TUNNEL USING DETERMINISTIC AND METAHEURISTIC ALGORITHMS

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This paper explores the use of deterministic and metaheuristic algorithms to optimally design building structures in a boundary layer wind tunnel. A combination of non-stochastic and stochastic optimization algorithms were implemented to minimize the magnitude of suction and positive pressures on the roof of a 1:18 scale rigid, low-rise building model with a parapet wall of variable height. A stochastic multi-objective optimization algorithm was later implemented to simultaneously minimize the magnitude of roof suction pressures and minimize base shear. Roof parapet walls can favorably alter the flow behavior near roof corners, alleviating suction loads on the windward facing roof corners and edges. At the same time, parapet walls increase the surface area of the building which results in larger drag forces at the base of the structure. Experiments were conducted at the University of Florida Experimental Facility (UFEF) of the National Science Foundation's (NSF) Natural Hazard Engineering Research Infrastructure (NHERI) program.