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Efficient Wind Fragility Analysis of Concrete Chimney under Stochastic Extreme Wind Incorporating Temperature Effects

Authors : Soumya Bhattacharjya, Avinandan Sahoo, Gaurav Datta

Abstract : Wind fragility analysis of chimney is often carried out disregarding temperature effect. However, the combined effect of wind and temperature is the most critical limit state for chimney design. Hence, in the present paper, an efficient fragility analysis for concrete chimney is explored under combined wind and temperature effect. Wind time histories are generated by Davenports Power Spectral Density Function and using Weighed Amplitude Wave Superposition Technique. Fragility analysis is often carried out in full Monte Carlo Simulation framework, which requires extensive computational time. Thus, in the present paper, an efficient adaptive metamodelling technique is adopted to judiciously approximate limit state function, which will be subsequently used in the simulation framework. This will save substantial computational time and make the approach computationally efficient. Uncertainty in wind speed, wind load related parameters, and resistance-related parameters is considered. The results by the full simulation approach, conventional metamodelling approach and proposed adaptive metamodelling approach will be compared. Effect of disregarding temperature in wind fragility analysis will be highlighted.

Keywords : adaptive metamodelling technique, concrete chimney, fragility analysis, stochastic extreme wind load, temperature effect
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