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Feedback control of the unsteady loading on a high-rise building XIAO HU, AIMEE MORGANS, Imperial College London — With the frequency of significant weather events increasing, it is critical to predict and mitigate the response of high-rise buildings to wind loading. In this work, turbulent wakes arising from air flow around a benchmark high-rise building – the Commonwealth Advisory Aeronautical Council (CAARC) building – are numerically investigated using Large Eddy Simulation (LES). Such buildings protrude into the atmospheric boundary layer. In this work, the synthetic eddy method is employed to simulate the oncoming air flow. The mean and unsteady forces and moments on the building are compared to available experimental results. The coherent flow structures are then analyzed with a view to informing the choice of sensors and actuators for feedback control. To attenuate the unsteady loading, actuation in the form of unsteady synthetic jets along edges of the building is implemented. The sensor for feedback control is the unsteady pressure force on the back face of the building. Harmonic openloop forcing across different frequencies and amplitudes is used to characterize the unsteady loading response to actuation, via fitting of a linear model. This model will be used to develop a linear feedback controller for reducing the unsteady loading, and its performance in simulations assessed.

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