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Efficient simulation of detached flows at high Reynolds number JOSE M. VEGA, VICTOR ASENSIO, RAUL HERRERO, ETSI Aeronauticos, Universidad Politecnica de Madrid, FERNANDO VARAS, EI Telecomunicacion, Universidad de Vigo — A method is presented for the computationally efficient simulation of quasi-periodic detached flows in multi-parameter problems at very large Reynolds numbers, keeping in mind a variety of applications, including helicopter flight simulators, control and certification of unmanned aerial vehicles, control of wind turbines, conceptual design in aeronautics, and civil aerodynamics. In many of these applications, the large scale flows (ignoring the smaller turbulent scales) are at most quasi-periodic, namely the Fourier transform exhibits a finite set of concentrated peaks resulting from the nonlinear passive interaction of periodic wakes. The method consists in an offline preprocess and the online operation. In the preprocess, a standard CFD solver (such as URANS) is used in combination with several ingredients such as an iterative combination proper orthogonal decomposition and fast Fourier transform. The online operation is made with a combination of high order singular value decomposition and interpolation. The performance of the method is tested considering the ow over a fairly complex urban topography, for various free stream intensities and orientations, seeking real time online simulations.

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