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PII: S0997-7546(16)30105-4
DOI: http://dx.doi.org/10.1016/j.euromechflu.2016.12.008
Reference: EJMFLU 3111

To appear in: *European Journal of Mechanics B/Fluids*

Received date: 23 March 2016
Revised date: 22 December 2016
Accepted date: 22 December 2016

Please cite this article as: A. Mariotti, L. Siconolfi, M.V. Salvetti, Stochastic sensitivity analysis of large-eddy simulation predictions of the flow around a 5:1 rectangular cylinder, *European Journal of Mechanics B/Fluids* (2016), http://dx.doi.org/10.1016/j.euromechflu.2016.12.008

Stochastic sensitivity analysis of large-eddy simulation predictions of the flow around a 5:1 rectangular cylinder

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Abstract

A stochastic analysis of the sensitivity to grid resolution and modeling of large-eddy simulations (LES) results is carried out for the flow around a 5:1 rectangular cylinder, which is the object of an international benchmark (BARC) collecting experimental and numerical flow realizations. Significant dispersion of the BARC predictions was observed for some quantities, also in LES, and deterministic sensitivity analyses were not conclusive. LES are carried out here by using a spectral-element numerical method. An explicit quadratic low-pass filter in the modal space is used, characterized by a cut-off value and by a weight function, which provides dissipation of the modes higher than the cut off and acts as a SGS dissipation. The uncertain parameters are the size of the spectral elements in the spanwise direction and the weight of the explicit filter. The impact of the uncertainty in these parameters is evaluated through generalized polynomial chaos. The analysis is repeated for two different grid resolutions in the streamwise and lateral di-

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