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Direct Numerical Simulation in the Sub-critical and Supercritical regimes for Flow past a Stationary Sphere SHASHANK S TIWARI[1], Institute of Chemical Technology, Mumbai, SHIVKUMAR BALE, University of Pittsburgh at Johnstown, ZHIZHONG DING, Louisiana State University; Shell Company, ASHWIN W. PATWARDHAN, Institute of Chemical Technology, Mumbai, KRISHNASWAMY NANDAKUMAR, Louisiana State University, JYESHTHARAJ B. JOSHI[2], Institute of Chemical Technology, Mumbai — The physical understanding of separating flows which exhibit critical phenomena under various flow conditions, have helped in designing various drag-reduction devices, turbulence generators, controllers, etc. Direct Numerical Simulation (DNS) of such separating flows helps to identify the flow structures and decipher the corresponding effects they have on the resulting forces. DNS being computationally intensive, the investigations for flow past a sphere has been limited to Re =10,000. In this study, we test the capability of OpenFOAM in performing fully resolved DNS for 1000 <Re <10^5. Appropriate time and length scales have been used to adequately resolve the boundary layer. Extensive simulations were performed to test, optimize and set a benchmarking case for the domain size, mesh size, time-step and discretization schemes required for performing such computationally intensive simulations on a scalable parallel platform. Simulations were run till a statistically converged solution was obtained. The drag coefficients and pressure coefficients from the simulations were compared against experimental results available in literature and were found to be in good agreement.

[1]Louisiana State University
[2]Homi Bhabha National Institute

Shashank S Tiwari
Institute of Chemical Technology, Mumbai

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