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DSMC Simulation of Flow Past a Circular Cylinder at $Re = 100$

J.R. TORCZYNSKI, M.A. GALLIS, Sandia National Laboratories — The Direct Simulation Monte Carlo (DSMC) method is used to simulate vortex shedding in the flow of a gas past a circular cylinder at $Re = 100$, $Ma = 0.1$ (incompressible), and $Kn = 0.00162$ (continuum). Sandia's DSMC code SPARTA is used. The domain is 5 diameters upstream, 10 diameters downstream, and 5 diameters on both sides and is meshed with 0.72 billion square cells with sides of $1/4$ mean free path. Each cell contains ~ 100 particles, for 72 billion particles total. The time step is $1/3$ of the mean collision time. Simulations are run on Sequoia, an IBM Blue Gene/Q petascale supercomputer at LLNL. The Kármán vortex street arises without using any perturbation, and the lateral force on the cylinder is periodic with a Strouhal number of 0.175. Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525. This paper describes objective technical results and analysis. Any subjective views or opinions that might be expressed in the paper do not necessarily represent the views of the U.S. Department of Energy or the United States Government.

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