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Large eddy simulations of in-cylinder turbulent flows.
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— A high-order numerical model is developed and tested for large eddy simulation (LES) of turbulent flows in internal combustion (IC) engines. In this model, the filtered compressible Navier-Stokes equations in curvilinear coordinate systems are solved via a generalized high-order multiblock compact differencing scheme. The LES model has been applied to three flow configurations: (1) a fixed poppet valve in a sudden expansion, (2) a simple piston-cylinder assembly with a stationary open valve and harmonically moving flat piston, (3) a laboratory single-cylinder engine with three moving intake and exhaust valves. The first flow configuration is considered for studying the flow around the valves in IC engines. The second flow configuration is closer to that in IC engines but is based on a single stationary intake/exhaust valve and relatively simple geometry. It is considered in this work for better understating of the effects of moving piston on the large-scale unsteady vortical fluid motions in the cylinder and for further validation of our LES model. The third flow configuration includes all the complexities involve in a realistic single-cylinder IC engine. The predicted flow statistics by LES show good comparison with the available experimental data.

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