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A dummy cell immersed boundary method for incompressible turbulence simulations over dirty geometries KEIJI ONISHI, RIKEN AICS, MAKOTO TSUBOKURA, Kobe University / RIKEN AICS — A methodology to eliminate the manual work required for correcting the surface imperfections of computer-aided-design (CAD) data, will be proposed. Such a technique is indispensable for CFD analysis of industrial applications involving complex geometries. The CAD geometry is degenerated into cell-oriented values based on Cartesian grid. This enables the parallel pre-processing as well as the ability to handle 'dirty' CAD data that has gaps, overlaps, or sharp edges without necessitating any fixes. An arbitrary boundary representation is used with a dummy-cell technique based on immersed boundary (IB) method. To model the IB, a forcing term is directly imposed at arbitrary ghost cells by linear interpolation of the momentum. The mass conservation is satisfied in the approximate domain that covers fluid region except the wall including cells. Attempts to Satisfy mass conservation in the wall containing cells leads to pressure oscillations near the IB. The consequence of this approximation will be discussed through fundamental study of an LES based channel flow simulation, and high Reynolds number flow around a sphere. And, an analysis comparing our results with wind tunnel experiments of flow around a full-vehicle geometry will also be presented.

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