

88a Large-Eddy Simulations of Turbulent Flows in Complex Confinements with Applications in Chemical Engineering

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Many transport processes in chemical engineering rely on strongly turbulent (and often multiphase) flows. When trying to realistically model such processes, one faces difficulties regarding the geometrical complexity and inhomogeneity of most process equipment (processes are hardly ever carried out in periodic domains with homogeneous, isotropic turbulence), and the coupling between turbulence and the from the perspective of the process rate limiting physical and chemical phenomena at the meso and micro scales (droplet break-up and coalescence, reactions, agglomeration, ...). This coupling is often of a nonlinear nature and therefore requires local, time-resolved information of the flow field. To a large extent, this information can be supplied by large-eddy simulations (LES). In this presentation, I will discuss LES of flows in complex confinements typically encountered in chemical engineering. To this end, lattice-Boltzmann discretization of the Navier-Stokes equation has been applied. This method provides geometrical flexibility, and good parallel performance allowing for highly resolved simulations. Results in the fields of solid-liquid mixing, gas-solid separation, and chemically reacting flows will be presented. Also the role of direct numerical simulations for providing subgrid models at the microscopic level will be highlighted.