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A computational model for large eddy simulation of dilute bubbly turbulent flows[1] MOHAMMAD HAJIT, FOTIS SOTIROPOULOS, St. Anthony Falls Laboratory, University of Minnesota — A mathematical formulation of filtered equations for two phase bubbly flows based on two-fluid method is presented. To remove high frequencies (noise), we extracted the filtered form of the equations in curvilinear coordinates, converting the microscopic governing equations to macroscopic equations via spatial averaging of solution variables. The set of equations describing the hydrodynamics in a gas-liquid system can be solved effectively if the solution procedure is decoupled so that an efficient iterative scheme can be employed. We propose a formulation for dilute bubbly flows in which the equations are converted to a loosely-coupled form. The resulting mathematical model is based on five distinct sets of equations, namely mixture momentum balance, pressure Poisson equation, Boyle's law and momentum and mass balances of gas phase. This mathematical formulation provides an efficient numerical procedure for two-way coupling of bubbly flows at low gas holdups. The subgrid-scale modeling is based on dynamic procedure of Germano for both phases. The formulation is validated for a fully turbulent bubble column test by comparing to available experimental results.

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