Abstract Submitted
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Binary gas mixture in a high speed channel DR. SAHADEV PRADHAN, Chemical Technology Division, Bhabha Atomic Research Centre, Mumbai-400 085, India — The viscous, compressible flow in a 2D wall-bounded channel, with bottom wall moving in? the positive $x-$direction, simulated using the direct simulation Monte Carlo (DSMC) method,? has been used as a test bed for examining different aspects of flow phenomenon and separation performance of a binary gas mixture at Mach number $Ma =$ *(U_w / \sqrt(γ k_B T_w /m)?)* in the range*0.1 <Ma <30*, and Knudsen number $Kn =$ *1/(\sqrt(2) π d^2 n_d H)*in the range? *.1 <Kn <10.* The generalized? analytical model is formulated which includes the fifth order differential equation for the? boundary layer at the channel wall in terms of master potential (χ), which is derived? from the equations of motion in a 2D rectangular $(x-y)$coordinate. The starting point? of the analytical model is the Navier-Stokes, mass, momentum and energy conservation? equations in the $(x-y)$coordinate, where $x$and $y$are the streamwise? and wall-normal directions, respectively. The linearization approximation is used ((Pradhan & Kumaran, *J. Fluid Mech* -); (Kumaran & Pradhan, *J. Fluid Mech* -)), where the equations of motion are truncated at linear order in the velocity and pressure perturbations to the base flow, which is anisothermal compressible Couette flow. Additional assumptions in the? analytical model include high aspect ratio *(L >>H)*, constant temperature in the base state (isothermal condition), and low? Reynolds number (laminar flow). The analytical solutionsare compared with direct simulation Monte Carlo (DSMC) simulations and found good agreement (with a difference of less than 10%), provided the boundary conditions are accurately incorporated in the analytical solution.

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