Binary gas mixture in a high speed channel DR. SAHADEV PRAD-
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400 085 — The viscous, compressible flow in a 2D wall-bounded channel, with bot-
tom 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 $Ma = (U\_w / \sqrt(\gamma\ k\_B\ T\_w\ /m)$ in the range $0.1 <Ma <30$, and
Knudsen number $Kn = 1/(\sqrt(2)\ \pi\ d\char`\^2\ n\_d\ H)$ in the range $0.1 <Kn <10$. 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* -2011); (Kumaran &
Pradhan, *J. Fluid Mech* -2014)), where the equations of motion are truncated at
linear order in the velocity and pressure perturbations to the base flow, which is
an isothermal 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 so-
lutions are 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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