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Analytical and Numerical Modeling of Strongly Rotating Rarefied Gas Flows SAHADEV PRADHAN, VISWANATHAN KUMARAN, Department of Chemical Engineering, Indian Institute of Science, Bangalore-560012, India — Centrifugal gas separation processes effect separation by utilizing the difference in the mole fraction in a high speed rotating cylinder caused by the difference in molecular mass, and consequently the centrifugal force density. These have been widely used in isotope separation because chemical separation methods cannot be used to separate isotopes of the same chemical species. More recently, centrifugal separation has also been explored for the separation of gases such as carbon dioxide and methane. The efficiency of separation is critically dependent on the secondary flow generated due to temperature gradients at the cylinder wall or due to inserts, and it is important to formulate accurate models for this secondary flow. The widely used Onsager model for secondary flow is restricted to very long cylinders where the length is large compared to the diameter, the limit of high stratification parameter, where the gas is restricted to a thin layer near the wall of the cylinder, and it assumes that there is no mass difference in the two species while calculating the secondary flow. There are two objectives of the present analysis of the rarefied gas flow in a rotating cylinder. The first is to remove the restriction of high stratification parameter, and to generalize the solutions to low rotation speeds where the stratification parameter may be *O(1)*, and to apply for dissimilar gases considering the difference in molecular mass of the two species. Secondly, we would like to compare the predictions with molecular simulations based on the direct simulation Monte Carlo (DSMC) method for rarefied gas flows, in order to quantify the errors resulting from the approximations at different aspect ratios, Reynolds number and stratification parameter.

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