Plane Poiseuille flow of a highly rarefied gas between the two walls of Maxwell-type boundaries with different accommodation coefficients: Effect of a weak external force TOSHIYUKI DOI, Department of Applied Mathematics and Physics, Tottori University — Plane Poiseuille flow of a highly rarefied gas between the two walls of Maxwell-type boundaries with different accommodation coefficients is studied based on kinetic theory when the gas is subject to a weak external force perpendicular to the walls. The flow behavior is studied numerically based on the spatially one-dimensional Boltzmann equation for a hard-sphere gas derived by the asymptotic analysis for a slow variation in the longitudinal direction. Due to the effect of a weak external force, there is an appreciable difference in the mass-flow rate between the flows in which the two walls are interchanged when the mean free path is sufficiently large. If both of the accommodation coefficients are close to unity, the mass-flow rate is reduced due to the effect of the external force. In contrast, if the accommodation coefficient of one wall is considerably smaller than unity, the mass-flow rate of the gas can be enhanced when this wall is placed on the side to which the external force points.

Toshiyuki Doi
Department of Applied Mathematics and Physics, Tottori University