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A model of micro lubrication between two walls with an arbitrary temperature distribution based on kinetic theory[1] TOSHIYUKI DOI, Tottori Univ — Micro lubrication of a gas between two walls with an arbitrary temperature distribution is studied on the basis of the Bhatnagar–Gross–Krook–Welander model of the Boltzmann equation. Applying the slowly varying approximation, the kinetic equation is studied analytically when the Knudsen number based on the gap size is large. The leading order approximation, which ought to be the solution of the nonlinear heat transfer problem, is replaced by its free molecular solution. Due to this crude approximation, a macroscopic lubrication model of Reynolds type equation is derived in a closed form. For an assessment of the model, direct numerical analyses of lubrication flows between nonuniformly heated or cooled walls are conducted. The lift calculated using our model approximates that of the direct numerical analysis within the error of 5 % over the range of the Knudsen number between 0.1 and 10 when the highest temperature of the wall is twice the lowest one.

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