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Second-order Knudsen-layer analysis for the generalized slip-flow theory: Boundary curvature effects[1] MASANARI HATTORI, Department of Mechanical Engineering and Science, Kyoto University, Kyoto 615-8540, Japan, SHIGERU TAKATA, Department of Aeronautics and Astronautics & Advanced Research Institute of Fluid Science and Engineering, Kyoto University, Kyoto 615-8540, Japan — A systematic asymptotic analysis of the Boltzmann equation shows that the overall behavior of a gas can be described by fluid-dynamic-type equations with the appropriate slip/jump boundary condition when the Knudsen number is small [the generalized slip-flow theory; see Y. Sone, *Molecular Gas Dynamics* (Birkhäuser, Boston, 2007)]. Near the boundary, a non-fluid-like correction (the Knudsen-layer correction) to the overall solution is required. Although the theory itself has been established up to the second order of the Knudsen number expansion, the data of the correction have been lacking for a long time for the original Boltzmann equation. Recently, we have obtained the required data, except for the effects of boundary curvature, assuming the hard-sphere molecules and the diffuse reflection boundary condition. In the present work, the effects of boundary curvature have been clarified in details, thereby completing the required numerical data. A local singularity appears at the level of the velocity distribution function. We have developed the numerical method that handles such a singularity safely.

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