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Modeling of Radiometric Force Actuation using the DSMC and ES/BGK Approaches A.A. ALEXEENKO, Purdue University, S.F. GIMELSHEIN, C. NGALANDE, University of Southern California — Radiometric Force Actuation (RFA) refers to a non-equilibrium phenomenon when a total force is exerted on an object submerged into a gas under the conditions of temperature inequality between the object and the gas container walls. The thermal stresses in the gas generate a flow which results in a force which has a maximum in rarefied regime. The flow is called "radiometric" because it is similar to the gas flow that rotates the vanes of Crookes' radiometer. This gas flow phenomenon combined with modern low heat-conductivity materials can be exploited to create microactuators driven by radiant or resistive heating. Two kinetic methods - the direct simulation Monte Carlo, a stochastic approach, and the discrete-ordinate solution of ES/BGK equation, a deterministic approach, are applied for analysis of the radiometric flow generated by an non-uniformly heated plate. The dependence of the radiometric force on the Knudsen number is examined as well as the effects of the non-uniform temperature distribution across the plate.

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