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The drag and lift of different non-spherical particles from low to high Re[1] SATHISH K. P. SANJEEVI, JOHAN PADDING, Delft University of Technology — The present work investigates a simplified drag and lift model that can be used for different non-spherical particles. The flow around different non-spherical particles is studied using a multi-relaxation-time lattice Boltzmann method. We compute the mean drag coefficient $C_{D,\phi}$ at different incident angles ϕ for a wide range of Reynolds numbers (Re). We show that the sine-squared drag law $C_{D,\phi} = C_{D,\phi=0^\circ} + (C_{D,\phi=90^\circ} - C_{D,\phi=0^\circ}) \sin^2 \phi$ holds up to large Reynolds numbers $Re = 2000$. The sine-squared dependence of C_D occurs at Stokes flow (very low Re) due to linearity of the flow fields. We explore the physical origin behind the sine-squared law at high Re, and reveal that surprisingly, this does not occur due to linearity of flow fields. Instead, it occurs due to an interesting pattern of pressure distribution contributing to the drag, at higher Re, for different incident angles. Similarly, we find that the equivalent theoretical equation of lift coefficient C_L can provide a decent approximation, even at high Re, for elongated particles. Such a drag and lift law valid at high Re is very much useful for Euler-Lagrangian fluidization simulations of the non-spherical particles.

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