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Laminar-turbulent transition and inertial shear-thickening of particle suspensions LUCA BRANDT, IMAN LASHGARI, FRANCESCO PICANO, Linné FLOW Centre and SeRC, KTH Mechanics, Stockholm, Sweden, WIM-PAUL BREUGEM, Laboratory for Aero & Hydrodynamics, TU-Delft, Delft, The Netherlands — When a suspension of rigid particles is considered instead of a pure fluid, the particle-fluid interactions significantly alter the bulk behavior of the flow unexplained effects appear in the transitional regime. These are important in several environmental and industrial applications. The aim of this study is to characterize the flow regimes of suspensions of finite-size rigid particles in a viscous fluid at finite inertia. We explore the system behavior as function of the particle volume fraction and the Reynolds number. Unlike single phase flows where a clear distinction exists between the laminar and the turbulent states, three different regimes can be identified in the presence of a particulate phase, with smooth transitions between them. At low volume fractions, the flow becomes turbulent when increasing the Reynolds number, transitioning from the laminar regime dominated by viscous forces to the turbulent regime characterized by enhanced momentum transport by turbulent eddies. At larger volume fractions, we identify a new regime characterized by an even larger increase of the wall friction. The wall friction increases with the Reynolds number (inertial effects) while the turbulent transport is unaffected, as in a state of intense inertial shear-thickening.

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