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Insights on rotor ensemble dynamics using a new scalable computational platform WEN YAN, MICHAEL SHELLEY, Flatiron Institute, Simons Foundation — Suspensions of Stokes rotors consist of immersed particles that are driven to rotate, with that rotation creating flow fields that can create large-scale coupling and dynamics. Such rotor systems are typically driven by external means, such as a rotating magnetic field. Here we study the dynamics of closely packed rotor systems using a new method that combines a high-order accurate fluid solver, based on integral equation methods, and a temporally stable particle-particle collision solver based on geometric constraint optimization. This new computational technique is scalable on parallel computer clusters and allows us to simulate the development of large-scale dynamics. We first report the internal dynamics of a monolayer consisting of 10,000 rotors, each driven by a torque perpendicular to the monolayer. This shows both large-scale collective dynamics and complex small-scale interactions. In the second example, we turn the torque sideways and find a Kelvin-Helmholtz-like instability of the monolayer induced by the particles' rotational flows and steric interactions.

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