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**Rotation of triaxial particles in shear and strain: From Jeffery orbits and alignment to oscillations and chaos** FREDRIK LUNDELL, Royal Institute of Technology — The rotation of non-spherical particles is a cornerstone for the understanding of particle motion in flows laden with (non-spherical) particles. Here, the rotary motion of triaxial ellipsoids in linear shear and strain is studied theoretically and numerically under the assumption of Stokes flow ($Re = 0$). The particle motion is modeled by coupling the torques (Jeffery 1922) with the equations of rotation. The problem is governed by the relationships between the two shorter and the major axis together with the Stokes number, obtained as the Reynolds number times the particle/fluid density ratio. The general behaviour is that the particle ultimately rotates with the shortest axis aligned with the vorticity axis in shear flow. In linear strain, the particle aligns with the strain. However, the route and time to reach this state is distinctively different for different parameter combinations. Furthermore, the ultimate state is unstable for certain parameter combinations and the particle instead moves in a chaotic manner. The results, valid at $Re = 0$, shows a wide range of behaviors and provide a firm base for the understanding of particle motion also at higher $Re$.

Fredrik Lundell
Royal Institute of Technology

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