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Angular velocity of a spheroid log rolling in a simple shear at small Reynolds number JAN MEIBOHM, Department of Physics, Gothenburg University, FABIEN CANDELIER, University of Aix-Marseille, TOMAS ROSEN, KTH Mechanics, Royal Institute of Technology, JONAS EINARSSON, Department of Physics, Gothenburg University, FREDRIK LUNDELL, KTH Mechanics, Royal Institute of Technology, BERNHARD MEHLIG, Department of Physics, Gothenburg University — We analyse the angular velocity of a small neutrally buoyant spheroid log rolling in a simple shear. When the effect of fluid inertia is negligible the angular velocity $\vec{\omega}$ equals half the fluid vorticity. We compute by singular perturbation theory how weak fluid inertia reduces the angular velocity in an unbounded shear, and how this reduction depends upon the shape of the spheroid (on its aspect ratio). In addition we determine the angular velocity by direct numerical simulations. The results are in excellent agreement with the theory at small but not too small values of the shear Reynolds number, for all aspect ratios considered. For the special case of a sphere we find $\omega/s = -1/2 + 0.0540\,Re^{3/2}$ where s is the shear rate and Re is the shear Reynolds number. This result differs from that derived by Lin et al. [J. Fluid Mech. 44 (1970) 1] who obtained a numerical coefficient roughly three times larger.

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