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Squirming motion of a sphere in a micropolar fluid SHANKAR NARASIMHA, D. PALANIAPPAN, Department of Mathematics Statistics, Texas AM University, Corpus Christi — Micropolar fluid continuum equations involve both the velocity and internal spin vector fields resulting in antisymmetric and couple stresses. In such micro-structured fluid continua the spin plays a kinematical role comparable to that played by the velocity in classical Newtonian problems. In this investigation, the problem of swimming in micropolar fluids via a spherical squirmer model is analyzed. The idealized configuration allows analytical solutions for the velocity and spin fields surrounding the squirmer via Stokes stream function formulation. The propulsion speed is calculated using the force-free condition which is, surprisingly, the same as that of the spherical microorganism swimming in Newtonian fluids. The power dissipation and swimming efficiency results derived using non-zero spin boundary conditions on the squirmer surface, however, reveal the micro-rotational effects. The analytical solutions are also utilized to inspect the structure of flow fields surrounding the spherical squirmer. The results may be of interest in understanding microorganisms swimming mechanisms in fluids that exhibit angular momentum due to internal micro-rotation.

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