

The Role of the Viscosity Parameters in the Large Time Asymptotics of 2D Micropolar Flows

Cilon Perusato

Federal University of Pernambuco, Brazil

We investigate the role of the four viscosity parameters, in fluids where the particles possess a microstructure (micropolar flows) and are allowed to rotate in a two-dimensional setting. We first establish the existence of global finite energy solutions, satisfying the classical energy equality, for arbitrary initial data in L^2 , in the case of a spin viscosity $\gamma \geq 0$, and we construct the asymptotic profiles of the solution as $t \rightarrow +\infty$. We deduce the remarkable fact that the large time behavior only depends on the kinematic viscosity μ , and not on the other parameters χ (vortex-viscosity), γ (spin viscosity) and κ (gyroviscosity) of the model. Our main tool is a new energy identity of independent interest, involving the difference between the fluid vorticity and the micro-angular velocity. Another consequence of our analysis is the identification of scenarios where the presence of micro-rotational effects significantly enhances dissipation, thereby slowing down the fluid motion at large times. This is a joint work with Lorenzo Brandolese (Université Lyon 1), Dragoş Iftimie (Université Lyon 1), and Valentina Busuioc (Université Jean Monnet).

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