Asymptotic analysis of the thermomicropolar fluid flow through a thin channel

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Abstract. The thermomicropolar fluid model represents an important generalization of the micropolar fluid model by taking into account the effects such as heat conduction and heat dissipation. The aim of this talk is to present our recent results on the steady-state flow of the thermomicropolar fluid through a thin channel. The heat exchange between the fluid inside the domain and the exterior medium is allowed through the upper wall, whereas the lower wall is insulated. Using the asymptotic analysis with respect to the thickness of the channel, we propose a higher-order asymptotic solution acknowledging the effects of the fluid's microstructure ([1]) and the domain's geometry ([2]). A rigorous justification of the proposed effective models is provided by proving the error estimates in suitable norms. We also address the setting in which the upper wall could be rough. Depending on the limit of the ratio between channels thickness and the wavelength of the roughness, we rigorously derive different asymptotic models clearly showing the roughness-induced effects on the average velocity and microrotation ([3]). To accomplish that, we employ the adaptation of the unfolding method to a thin-domain setting.

The results are obtained in collaboration with G. Lukaszewicz (University of Warsaw), M. Radulović, B. Rukavina (University of Zagreb), and F.J. Suárez-Grau (Universidad de Sevilla).

References

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