# Asymptotic analysis of micropolar fluid flow through a thin pipe

(Talk)

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The micropolar fluid model is an essential generalization of the well-established Navier-Stokes model which takes into account the microstructure of the fluid. It describes the behavior of numerous real fluids (e.g. polymeric suspensions, liquid crystals, muddy fluids, animal blood, etc.) better than the classical model. The aim of this talk is to present recent results about asymptotic approximation of the micropolar fluid flow through a thin (or long) pipe with circular cross-section. We begin by considering an incompressible micropolar fluid flowing through an undeformed straight pipe and find the effective behavior of the flow via rigorous asymptotic analysis with respect to the pipe's thickness. Engineering practice requires extensive knowledge of curved-pipe flows so we extend our analysis to the case of curved pipe with an arbitrary central curve. Using curvilinear coordinates and two-scale asymptotic expansion, we construct the approximation explicitly acknowledging the effects of fluid microstructure and pipe's distortion. We also provide the rigorous justification of the obtained effective model by proving the corresponding error estimates. Last but not least, we study the transport of a reactive solute through a cylindrical pipe filled with micropolar fluid and in the presence of chemical reaction. We formally derive the asymptotic model showing explicitly the effects of chemistry and fluid microstructure on the solute dispersion.

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