The Mathematical Analysis of Selected Flows Problems

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Lecture 1:

Modeling and Analysis of the Ericksen-Leslie Model for Nematic Liquid Crystal Flows

In this series of talks we discuss aspects of modeling and analysis of the Ericksen-Leslie equations describing nematic liquid crystal flow both in the isothermal and non-isothermal situation. The analytic understanding of the dynamics of the underlying system will be based on the entropy principle as well as on the theory of quasilinear parabolic evolution equations. In particular, we discuss well-posedness, regularity and long-time behaviour results for strong solutions for the Ericksen-Leslie model in the case of isotropic elasticity, both for the simplified model as well as for the general system subject to general Leslie stress.

Lecture 2:

Global Strong Well-Posedness of the Primitive Equations of Ocean Dynamics

In this series of talks we discuss the primitive equations of the ocean and the atmosphere, which are considered to be a fundamental model for many geophysical flows. We develop a framework based on the hydrostatic Stokes operator in the L_p-setting, which allows to deduce global well-posedness results for arbitrary large data belonging to certain classes of function spaces. In addition, we discuss the long-time behaviour of strong solutions as well as the situation of periodic and steady-state solutions subject to large forces.