数学与系统科学研究院

计算数学所学术报告

(定期学术报告)

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报告题目：

Numerical investigation for a macroscopic model for hydrodynamic nematic liquid crystals

邀请人： 郑伟英副研究员

报告时间： 2009 年 4 月 2 日(周四)

下午 4:00—5:00

报告地点： 科技综合楼三层 311

计算数学所报告厅

Abstract:

We use finite element methods to simulate the hydrodynamical systems governing the motions of nematic liquid crystals in a bounded domain. We reformulate the original model in the weak form which is consistent with the continuous dissipative energy law for the flow and director fields. This enables us to use convenient conformal C0 finite elements in solving the problem. Moreover, a discrete energy law is derived for a modified midpoint time discretization scheme. A fixed iterative method is used to solve the resulted nonlinear system so that a matrix free time evolution may be achieved and velocity and director variables may be solved separately. A number of hydrodynamical liquid crystal examples are computed to demonstrate the effects of the parameters and the performance of the method. At last we will present an example of this macroscopic model for complex fluids in ``1+2''

dimension case. It be found that the direction of the molecules will tumble from the boundary layer and later on the inner layer with a much longer time period. This is consistent with the theoretical predict of special case. Moreover, we find some complex phenomena, where the tumbling rises from boundary layer then is deep into the middle area more clearly when the viscosity coefficient of the macro flow has a larger value. The norm of the molecular director would endure greater change as well. This implies that the viscosity of flow plays the role of an accelerator in the whole complex fluids. Comparing these results with the theoretical analysis, we can find that the gradient of the velocity has direct impact on the tumbling phenomena. These results roughly show that such a scheme is capable of giving rich phenomena embedded in the macro–micro model.

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