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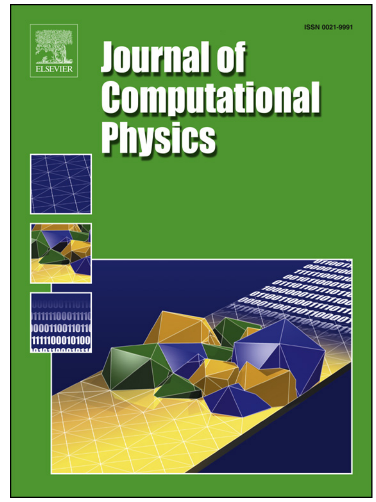

A mesh adaptivity scheme on the Landau–de Gennes functional minimization case in 3D, and its driving efficiency

Iztok Bajc, Frédéric Hecht, Slobodan Žumer

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A mesh adaptivity scheme on the Landau-de Gennes functional minimization case in 3D, and its driving efficiency

Iztok Bajc[1], Frédéric Hecht[2 3 4], Slobodan Žumer[1 5]

ABSTRACT

This paper presents a 3D mesh adaptivity strategy on unstructured tetrahedral meshes by a posteriori error estimates based on metrics derived from the Hessian of a solution. The study is made on the case of a nonlinear finite element minimization scheme for the Landau-de Gennes free energy functional of nematic liquid crystals. Newton's iteration for tensor fields is employed with steepest descent method possibly stepping in.

Aspects relating the driving of mesh adaptivity within the nonlinear scheme are considered. The algorithmic performance is found to depend on at least two factors: when to trigger each single mesh adaptation, and the precision of the correlated remeshing. Each factor is represented by a parameter, with its values possibly varying for every new mesh adaptation. We empirically show that the time of the overall algorithm convergence can vary considerably when different sequences of parameters are used, thus posing a question about optimality.

The extensive testings and debugging done within this work on the simulation of systems of nematic colloids substantially contributed to the upgrade of an open source finite element-oriented programming language to its 3D meshing possibilities, as also to an outer 3D remeshing module.

[1]Fakulteta za matematiko in fiziko, Univerza v Ljubljani, Jadranska 19, Ljubljana SI-1000, Slovenija

[2]Sorbonne Universités, UPMC Univ Paris 06, UMR 7598, Laboratoire Jacques-Louis Lions, F-75005, Paris, France

[3]CNRS, UMR 7598, Laboratoire Jacques-Louis Lions, F-75005, Paris, France

[4]INRIA-Paris-Rocquencourt, EPC ***, Domaine de Voluceau, BP105, 78153 Le Chesnay Cedex

[5]Inštitut Jožef Stefan, Jamova 39, Ljubljana SI-1000, Slovenija