

Relaxation of the Cahn-Hilliard model for the modelling of solid tumors and its numerical simulation

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The Cahn-Hilliard equation, arising from physics, describes the phase separation occurring in a material during a sudden cooling process and is the subject of many research pieces. An interesting application of this equation is its capacity to model cell populations undergoing attraction and repulsion effects. In order to model solid tumors, we consider a variant of the original Cahn-Hilliard equation that features a single-well potential and a degenerate mobility. This particular form of the model induces numerous difficulties, especially concerning its numerical simulation. We propose a relaxation of the equation to tackle these issues and analyze the resulting system [1]. We also describe a simple finite element scheme that preserves the critical physical (or biological) properties of the solutions using the regularization effect induced by our relaxation method [2].

- [1] B. Perthame, A. Poulain. *Relaxation of the Cahn-Hilliard equation with singular single-well potential and degenerate mobility*. European J. Appl. Math., **32(1)**, 89–112, 2021. doi : 10.1017/s0956792520000054.
- [2] A. Poulain, F. Bubba. *A nonnegativity preserving scheme for the relaxed Cahn-Hilliard equation with single-well potential and degenerate mobility*. arXiv preprint arXiv :1910.13211, 2020.

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