Comparing different upwind schemes for Chemotaxis PDE systems.

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Chemotaxis is the spatial migration of cells with respect signals. In the last decades, a great quantity of chemotaxis PDE systems have been studied, modeling interaction between live organisms (cells for instance) and chemical signals. Jointly to chemotaxis, other effects are considered as self-diffusion, production or consumption of signal by cells, logistic growth of cells, etc.
These chemotaxis PDE systems have some important properties as conservation, nonnegativity, the existence of a dissipative free energy, etc. Then, to design efficient fully discrete numerical schemes preserving these properties is a challenge topic.
In this talk we will review some different upwind techniques, either with Discontinuous Galerkin approximations [1] or using Finite Element methods with regularization of an adequate singular energy [2, 3], which let us to determine some efficient schemes.
Cette contribution est dans le cadre du minisymposium " Méthodes d'approximation pour des problèmes issus de la biologie"

Références

[1] Acosta, D. ; Guillen-Gonzalez, F. ; Rodriguez-Galvan, J.R. ; An unconditionally energy stable and positive upwind DG scheme for the Keller-Segel model. Journal of Scientific Computing, (2023) 97 :18.

[2] Guillen-Gonzalez, F. ; Rodriguez-Bellido, M.A. ; Rueda-Gomez, D.A. ; Comparison of two finite element schemes for a chemo-repulsion system with quadratic production. Applied Numerical Mathematics. 173, (2022) 193-210.

[3] Guillen-Gonzalez, F. ; Tierra, G. ; Finite Element numerical schemes for a chemoattraction and consumption model. Journal of Computational and Applied Mathematics 441 (2024).

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