A positivity preserving finite element scheme for a Keller–Segel system

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In this talk, we consider the Keller–Segel system for chemotaxis on a bounded two-dimensional domain. The system consists of two coupled parabolic partial differential equations that describe the cell density and the chemical concentration. Since the standard finite element method fails to preserve the positivity of the discrete solutions, we consider a stabilized finite element scheme that preserves the positivity. This stabilized scheme is constructed using the Algebraic Flux Correction (AFC) method.

As the resulting fully discrete scheme is nonlinear, we discuss its well-posedness. In addition, we derive a residual-type a posteriori error estimator. Finally, we present numerical experiments that validate the theoretical results.

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