A positivity-preserving DDFV scheme for a cross-diffusion system

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This work is devoted to the design and implementation of a second-order Discrete Duality Finite Volume (DDFV) scheme for a coupled diffusion system on general polygonal meshes. A central issue in this setting is the preservation of the non-negativity of the numerical solution, a fundamental physical requirement in diffusion models. To address this difficulty, we introduce a suitable flux construction within the DDFV framework that combines positivity preservation with second-order accuracy. The proposed approach is formulated directly at the level of the discrete flux operators, so that the positivity-preserving property is ensured without degrading accuracy and consistency. Numerical experiments on polygonal meshes confirm the expected order of accuracy and illustrate the robustness of the proposed method for several test configurations.

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