STRUCTURE-PRESERVING LOCAL DISCONTINUOUS GALERKIN METHOD FOR NONLINEAR CROSS-DIFFUSION SYSTEM

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Abstract. The main difficulty in the design of methods for the numerical approximation of cross-diffusion systems is that the diffusion matrix may be nonsymmetric and not positive semidefinite. In this talk, we present a high-order Local Discontinuous Galerkin method for the discretization of nonlinear cross-diffusion systems. In the spirit of [1], we rewrite the original problem in terms of an entropy variable.

The method is designed so that:

i) it naturally preserves the positivity and boundedness of the exact solution, even if a maximum principle is not available;

ii) nonlinearities do not appear within differential operators, thus reducing the computational cost of the method;

iii) a chain rule involving the auxiliary variables is weakly imposed, which allows us to show a discrete entropy stability estimate.

We present several numerical experiments that validate our theoretical results.

∗ This is a joint work with Ansgar Jüngel and Ilaria Perugia.

Keywords: cross-diffusion systems; Local Discontinuous Galerkin method; structure-preserving; entropy variable.

Mathematics Subject Classifications (2010): 65M60; 65M12; 35K55; 35K57.

References

[1] A. Jüngel. The boundedness-by-entropy method for cross-diffusion systems. Nonlinearity, 28:1963–2001, 2015.

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