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Discontinuous Hermite Collocation and Runge-Kutta schemes for multi-domain linear and non-linear brain tumor invasion models [1]

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Abstract

Growth simulation models of aggressive forms of malignant brain tumors have been well developed over the past years. In our recent works we have considered both novel analytical and numerical methods for the efficient treatment of brain tumor models that, apart from proliferation and diffusion, are being characterized by a discontinuous diffusion coefficient to incorporate the heterogeneity of the brain tissue. In this direction we have recently introduced a Discontinuous Hermite Collocation (DHC) finite element method, with appropriately discontinuous basis functions associated with the discontinuity nodes. The method was coupled with Diagonally Implicit (DI) Runge-Kutta schemes and studied for a three region linear model to reveal its high order approximation properties. In this work, we consider extending our results in the following directions:

- Employment of both linear and non-linear multi-domain brain tumor models
- Coupling of the DHC with both DI and Strong Stability Preserving (SSP) Runge-Kutta schemes.

Their behavior is being examined and several experiments are included to demonstrate their performance.

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