Conservative High Order Positivity-Preserving Discontinuous Galerkin Methods for Linear Hyperbolic and Radiative Transfer Equations

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In this presentation, we develop and analyze a conservative high order positivity-preserving DG method for both linear hyperbolic equations and radiative transfer equations. In the one dimensional case, a key result is proved that the DG solver based on the traditional Pk space can maintain positivity of the cell average if the inow boundary value and the source term are both positive, therefore the scaling positivity-preserving limiter can be used to obtain a high order conservative positivity-preserving DG scheme. In two dimensions we show that the DG solver based either on Pk or Qk spaces could generate negative cell averages. We augment the DG space with additional functions so that the positivity of cell averages from the DG solver can be restored, thereby leading to high order conservative positivity-preserving DG scheme based on these augmented DG spaces. Computational results are provided to demonstrate the good performance of our DG schemes.