Jennifer Ryan
University of East Anglia & Heinrich Heine University

Utilizing Geometry of Smoothness-Increasing-Accuracy-Conserving (SIAC) filters for reduced errors

Smoothness-Increasing Accuracy-Conserving (SIAC) filters for Discontinuous Galerkin (DG) methods are designed to increase the smoothness and improve the convergence rate of the DG solution form p+1 to 2p+1 through post-processing. However, introducing these filters can be challenging for multi-dimensional data since a tensor product filter grows in support size as the field dimension increases [(3p+2)*h]^d, where p + the polynomial order and d is the dimension. This becomes computationally prohibitive as the dimension increases. An alternative approach is to utilize a one-dimensional univariate filter. In this talk we introduce the Line SIAC filter and explore how the orientation, structure and filter size affect the order of accuracy and global errors. We show how line filtering preserves the properties of traditional tensor product filtering, including smoothness and improvement in the convergence rate, given an appropriate rotation. Furthermore, numerical experiments are included, exhibiting how these filters achieve the same accuracy at significantly lower computational costs.