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Insights on the Coercivity of the ESFR methods for Elliptic Problems

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The Flux Reconstruction approach is a recent high-order method which has been introduced for unsteady problems. Initial energy stability has been conducted for the advection problem, leading to the well know Energy Stability Flux Reconstruction (ESFR) schemes. Using the ESFR schemes, the energy stability proof has been extended for the advection-diffusion using the Local Discontinuous Galerkin (LDG) numerical flux. Quite recently, stability conditions were derived for the compact Internal Penalty (IP) and Bassi-Rebay II numerical fluxes. Moreover numerical simulations, satisfying the stability condition, have shown that taking particular ESFR schemes yields more accurate results than the classical DG method.

The main goal of this paper is to apply the ESFR schemes to elliptic problems and to study its properties compared to the classical DG method. Firstly we show that the stability condition obtained for the ESFR schemes for the diffusion equation also implies the coercivity of the bilinear form associated to Poisson's equation for the same ESFR schemes. Secondly, we will show that employing a compact numerical flux with particular ESFR schemes yields a potent method to solve Poisson's equation.

REFERENCES

[1] P.Castonguay, D.M. Williams, P.E. Vicent and A.Jameson *Energy stable flux reconstruction schemes for advection diffusion problems*. Computer Methods in Applied Mechanics and Engineering, pp 400-417, 2013.

[2] D.M. Williams, P.Castonguay, P.E. Vincent, and A.Jameson. *Energy stable flux reconstruction schemes for advection-diffusion problems on triangles*. Journal of Computational Physics, pp 53-76, 2013.

[3] S. Quaegebeur and S. Nadarajah. *Stability of Energy Stable Flux Reconstruction for the Diffusion Problem using the Interior Penalty and Bassi Rebay II schemes for triangular elements*, *In Preparation*.