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SOLVING CONVECTION DIFFUSION PROBLEMS WITH A PSEUDO SPECTRAL METHOD ON UNSTRUCTURED MESHES

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Abstract

We saw in [H. Nkounkou, A. Traoré, G. Séworé, M. A. Abani and B. Mampassi, Least squares collocation methods for solving partial differential equations: a matlab approach, Pioneer Journal of Computer Science and Engineering Technology 1(2) (2011), 57-71; H. Nkounkou, A. Traore, G. Seworé, A. M. Abani and B. Mampassi, Spectral differentiation on unstructured meshes using Jacobi Gauss-Lobatto points, Far East Journal of Applied Mathematics 59(2) (2011), 105-122] that the approximation of differentiation operators of order 2 was less good because of errors in the second derivation. To compensate this problem, we propose in this article an alternative method for approximating differentiation operators of order 2 by means of collocation points and we present an algorithm for solving a convection diffusion problem in complex geometry domains using differentiation matrices with Jacobi Gauss Lobatto points. We develop Matlab codes for solving the problem by a Least squares collocation method. Least squares collocation methods are considered as alternative to least squares finite elements methods [W. Heinrichs, An adaptive spectral least squares spectral collocation method with triangular elements for the incompressible Navier-Stokes equations, Springer and Business Media (2006), 337-350; D. Pathria and G. E. Karniadakis, Spectral element methods for elliptic problems in non smooth domains, Journal of Computational Physics 122 (1995), 83-95] and are particularly very attractive for solving partial differential equations on complex geometry domains. A numerical example is supporting our paper.

Keywords and phrases: Gauss-Lobatto points, differentiation matrices, triangular meshes, least squares collocation methods, complex geometry domains.