Solution of the transport equation by the collocation method in conjunction with the adaptive hermite element family

Bhuiyan, M.A., Allayla, R.I., Hussain, T., Ishaq, A.M., Mohsen, M.F.N.

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Abstract: The solution of the advection-dominated transport equation exhibits behavior whose structure is localized in small subregions of the spatial domain. This requires placing a high-resolution spatial grid in their vicinity. In an attempt to increase the spatial resolution, a family of 16 adaptive Hermite elements has been developed. Collocation methodology in conjunction with these adaptive families produces a matrix whose bandwidth is larger than using cubic Hermite elements all over the solution domain. A special technique is devised to condense out this bandwidth prior to the solution of the global system. The numerical solutions are tested against the available one- and two-dimensional analytical solutions. For the discretization attempted, the code was tested up to a Peclet number of 600 in one dimension and 200 in two dimensions. -Authors