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Development of Meshfree-IDO Scheme for Solving Advection and Diffusion Problems

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In this paper, a novel meshfree method employing the idea of IDO (Interpolated Differential Operator) scheme is presented.

IDO is a highly accurate, efficient ad stable numerical scheme for solving several kinds of partial differential equations (PDEs). In IDO, the basis equations are regarded as a differential operator and the higher order time derivatives are replaced by the spatial derivatives. IDO generally utilizes "regular" grids and each grid keeps a function value and its derivatives, which constructs the higher order Hermite interpolation for the approximation of the function space.

On the other hand, using "regular" grids has great disadvantage to handle objects with complicated geometry, such as fluid-structure interaction problem, multi phase flow and so on. In order to overcome this disadvantage, applying the basic idea of gridless or meshree method could be one of the possible choices.

Bearing these in mind, in this paper, a novel mesfree-IDO scheme is proposed, which makes use of advantages of the both methods and can solve PDEs accurately even using "irregular" grids. For this purpose, the generalized moving least squares approximation that can construct the Hermite type approximation space is adopted.

In order to demonstrate the potential of the proposed meshfree-IDO scheme, advection and diffusion problems are solved. Finally, the accuracy, the convergence rate and the computational efficiency are investigated comparing with the conventional methods and satisfactory results are obtained,

References

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