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Performance Analysis of a High Order Immersed Interface Method for CFD Applications

***Paulo Celso Vieira Paino, Marcello Augusto Faraco de Medeiros**

Escola de Engenharia de São Carlos, Universidade de São Paulo, Av. Trabalhador São-carlense, 400, São Carlos, São Paulo, Brasil.

*Corresponding author: paulo_paino@hotmail.com

In Computational Fluid Dynamics, the physical representation of immersed objects within these computational domains leads to the loss of validity of the employed Finite Difference Schemes due to Jump Discontinuities. This paper analyzes an Immersed Interface Method regarding its performance in High Order Schemes applications in the presence of such conditions. The error decay order of two 1D problems is observed. The first relates to the Heat Equation subjected to the unitary initial condition, whereas the second relates to the computation of the first two derivatives of functions Sin and Hyperbolic Tangent. The results indicate eventual changes in the decay order of the original Finite Differences Schemes. This behavior is investigated by a fragmented analysis of the method, which indicates both a dependency on the nature of the discretized function and a limitation of one of its numerical sub-steps. Finally, some remarks regarding restrictions to this method´s applicability are presented.

Keywords: High Order Schemes, Immersed Interface Method, Immersed Boundaries Method, CFD.