

Analysis and Applied Mathematics Seminar

Semi-Analytical Time Differencing Methods for Stiff Problems

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Abstract: A semi-analytical method is developed based on conventional integrating factor (IF) and exponential time differencing (ETD) schemes for stiff problems. The latter means that there exists a thin layer with a large variation in their solutions. The occurrence of this stiff layer is due to the multiplication of a very small parameter ϵ with the transient term of the equation. Via singular perturbation analysis, an analytic approximation of the stiff layer, which is called a corrector, is sought for and embedded into the IF and ETD methods. These new schemes are then used to approximate the non-stiff part of the solution. Since the stiff part is resolved analytically by the corrector, the new method outperforms the conventional ones in terms of accuracy. In this paper, we apply our new method for both problems of ordinary differential equations and some partial differential equations.

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