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On the convergence in ℓ_p norms of a MoL approach based on AMF-W-methods for m-dimensional linear parabolic problems of diffusion-reaction type

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Results of convergence in ℓ_p-norms for a MoL (Method of Lines) approach applied to m-dimensional ($m \geq 2$) linear parabolic problems of diffusion-reaction type on rectangular domains, are supplied. The space semi-discretization is based on central differences and the time integration is carried out with AMF-W-methods, which reduce the algebra computational costs to the level of one-dimensional problems on each spatial direction, in a similar way as methods of Alternating Direction Implicit-type (ADI) do.

Most of known results on convergence (PDE convergence) are restricted to the ℓ_2-norm and currently depend on the number of spatial dimensions m. Here, we present results of convergence (PDE convergence) of order two in time (and in space) in both norms (ℓ_2 and ℓ_∞), independently of the number of space dimensions m and of the spatial grid, when time-independent boundary conditions are considered. In case of time-dependent boundary conditions, the PDE order of convergence is *almost* two in the ℓ_2-norm when $m \geq 2$ and order one in the uniform norm for $m \geq 3$. Besides for $m = 2$, a slight modification of the AMF-W method allows to get convergence of order *almost* two in the uniform norm. Some ideas about the proofs are presented and some numerical examples to illustrate the theory are also given.

References

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