Fast Solution of Time-Dependent Fractional PDEs: Sparse and Limited Memory Block Preconditioners

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In our talk, we propose an innovative algorithm for the large (dense) linear systems of time–dependent partial fractional differential equations discretized in time with linear multistep formulas, both in classical [1] and in boundary value form [2]. We use, in both cases, the short–memory principle to ensure the decay of the entries of sparse approximations of the discretized operator and its inverse.

Standard Krylov methods with preconditioners based on short–memory principle as well are then used to solve the underlying sequence of linear systems, while FGMRES method is used for the systems in boundary value form. The sparse approximate inverse preconditioners for linear multistep formulas in classical form are implemented on GPU devices by means of the techniques proposed in [3]. Notes on recent tests for some nonlinear time–fractional problems will be also presented.

References

[1] D. Bertaccini, F. Durastante, *Solving mixed classical and fractional partial differential equations using short memory principle and approximate inverses*, Numer. Algorithms, 74(4) (2017) 1061–1082.

[2] D. Bertaccini, F. Durastante, *Limited memory block preconditioners for fast solution of fractional partial differential equations*, Submitted, (2017) 1–19.

[3] D. Bertaccini, S. Filippone, *Sparse approximate inverse preconditioners on high performance GPU platforms*, Comput. Math. Appl., 71(3) (2016) 693–711.