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BDDC AND FETI-DP METHODS IN PETSC

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PETSc [1] is a widely used suite of data structures and routines for the scalable solution of scientific applications modeled by PDEs. It is an object oriented library written in C and parallelised with MPI which can exploit different backends for matrix and vector operations such as shared memory parallelism on the CPU (using pthreads or OpenMP), NVIDIA GPUs (with CUDA) and Xeon Phi co-processors (via OpenCL).

Balancing Domain Decomposition by Constraints [2] (BDDC) and Finite Element Tearing and Interconnecting Dual Primal [3] (FETI-DP) methods are among the most powerful methods for preconditioning linear systems arising from the solution of linear or nonlinear PDEs. They have been successfully applied to many different kind of PDEs, represented by symmetric or non-symmetric bilinear forms, either positive definite or indefinite. The robustness of the methods has been theoretically and numerically proven for different discretizations, from low-order finite elements to spectral elements and NURBS based discretizations arising from IsoGeometric Analysis.

In this talk we will briefly introduce the BDDC and FETI-DP methods with a strong emphasis on algorithmic aspects. The current implementation of such methods, provided to the PETSc library by the corresponding author, will be presented, together with available user customizations. Future developments will be also discussed.

A wide range of experimental results regarding scalability and robustness of the algorithms will be also given. Results for large scale simulations on the BlueGene/Q machine FERMI located at CINECA will be provided.

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