Algebraic Multigrid variants are popular and effective choices for the preconditioning of Krylov subspace methods in the solution of large and sparse linear systems arising in many application areas.

The race to achieve Exascale computing, that is, the availability of computing platforms capable of executing $10^{18}$ arithmetic operations per second, has produced a substantial amount of research into extreme scalability. Effective preconditioners need to address two separate issues:

**Algorithmic scalability**: the ability to converge in the same number of iterations irrespective of the system size and of the number of computing cores employed;

**Implementation scalability**: the ability to execute computations at the same rate on each computing element, as the size of the system and the number of computing elements grow.

In [1] we have introduced coarsening software for algebraic multigrid based on Graph Matching techniques in serial mode; an immediate extension by decoupled application was discussed in [2]. These coarsening strategies have proven to be quite effective in enabling algorithmic scalability as the linear system size varies; in this talk we will turn our attention to the use of parallel matching schemes to provide better algorithmic scalability as the computational platform grows to exascale levels. We will discuss the underlying theory, the current implementation status, and will present some experimental results obtained on applications in the context of the Energy Oriented Centre of Excellence EoCoE-II project, funded by the EU.

This work was partially supported by EU Grant 824158 — EoCoE-II.

References


---

1 Cranfield University, UK, and IAC-CNR, Italy
2 IAC-CNR, Italy