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HiCMA: Hierarchical Computations on Manycore Architectures library

The Hierarchical Computations on Manycore Architectures library (HiCMA) aims to tackle the challenge that is facing the linear algebra community due to an unprecedented level of on-chip concurrency, introduced by the manycore era. HiCMA is a high performance numerical library, which implements hierarchical numerical algorithms (e.g., matrix computations, eigenvalue decomposition, H-matrix, FMM, etc.) on emerging architectures. The hierarchy expression of the algorithms allows to enhance data locality (communication-reducing), while still ensuring embarrassingly parallel workloads (synchronization-reducing). The core idea is to redesign the numerical algorithms and to formulate them as successive calls to hierarchical computational tasks, which are then scheduled on the underlying system using a dynamic runtime system to ensure load balancing. The algorithm is then represented as a Directed Acyclic Graph (DAG), where nodes represent hierarchical tasks and edges show the data dependencies between them.