Overview

LAMA is a framework for building efficient, extensible and flexible solvers for sparse linear systems and in application domains that involve – sparse and dense – numerical linear algebra. It supports heterogeneous shared and distributed memory compute architectures including various accelerators.

LAMA addresses users working on linear algebra with huge sparse matrices on HPC clusters within heterogeneous environments. Possible use cases for LAMA can be found in solving partial elliptic differential equations, image processing and generic BLAS applications. LAMA's code portability will extend your productivity not influencing numerical stability of the application.

Features

easy-to-use text-book-syntax
in heterogeneous environments
with implicit multinode parallelization
supporting multiple matrix structures
and various numerical requirements

BLAS operations
in heterogeneous environments
Target Backends
Programming APIs
Distributions
Matrix Formats
Iterative Linear Solvers

Architecture

LAMA's software stack is constructed of backends for the compute locations - capitalising the different programming APIs - a C++ core implementation and a solver framework. The core provides all the key features as the text-book-syntax, the memory management and implicit parallelization, which are used to build the solvers on the next level. User applications can directly interface the LAMA API or middleware using LAMA, e.g. OpenFOAM.

Code Samples

MetaMatrix A( "symMatrix.mtx", "matrix.dsl" );
DenseVector b ( "rhs.dsl" );
DenseVector x ( "sol.dsl" );

metaSolver.initialize( A );
metaSolver.solve( x, b );

Release Information

LAMA is available under the MIT License, a free software license originating at the Massachusetts Institute of Technology.

Our first release LAMA Alpamayo is available on SourceForge.net. To get the latest update or for experimental features you can check out our GIT branches.

Benchmarks

Single-Node Performance* (in Comparison)

Multi-Node Performance* (Weak Scaling of a CG-Solver)

Future Work

Due to the easily expandable design LAMA will be broadened to more backends, with more solvers and upcoming sparse matrix formats or distribution patterns. Recent work includes a FPGA backend, automatic distribution strategies and interfaces to other programming languages as C, Python, etc. LAMA will be integrated into high level languages as MatLab or OpenFOAM.


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