Asynchronous Linear Solvers

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Linear systems

Fluid dynamics
Lattice QCD
Quantum Mechanics
Heat transfer
Electromagnetic potential
Structural Analysis

Finite Elements
Finite Differences

Ax = b

Solution!
(Magic (usually 42))
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Solvers

Variants
- Block (multiple RHS)
- Communication avoiding
  Asynchronous

Solvers
- Additive Schwarz
- Multigrid
  (block-)Jacobi
- Gauss-Seidel
- SOR
- CG
- GMRES
- Bi-CGSTAB

Kernels
- NORM: \( y = \alpha x + \beta y \)
- DOT: \( (x, y) \)
- AXPY: \( \|x\| \)
- SPMV: \( Ax \)
- TSPMV: \( A^T x \)

The holy grail
- Numerical stability
- High convergence rate
- Generality
- Scalability
- Resilience
- Low memory consumption

Ax = b

[Variants...] [Preconditioner] Accelerator Solution!
(usually 42)
Asynchronator

MPI
CUDA
C++11/14
Git
GitLab
Doxygen
CMake
GTest

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