Julia, Portable Numerical Linear Algebra, and Beyond

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Abstract

Nearly 20 years ago, Demmel, Dongarra et. al. wrote in the Linear Algebra Working Notes (LAWN) 181 what appears to be a nearly impossible combinatorial explosion of challenges:

(1)	for all linear algebra problems
	(linear systems, eigenproblems,)
(2)	for all matrix types
	(general, symmetric, banded,)
(3)	for all data types
	(real, complex, single, double, higher precision)
(4)	for all machine architectures
	and communication topologies
(5)	for all programming interfaces
(6)	provide the best algorithm(s) available in terms of
	performance and accuracy ("algorithms" is plural because sometimes
	no single one is always best)

Twenty years later the concept of data types has extended to many more important possibilities (e.g., quaternion, mixed precision), GPUs have grown in importance and in number, and how linear algebra is integrated into larger applications has grown to become more complex than the traditional library model. Nonetheless, the dream of solving this problem remains, and we believe that the abstractions provided by Julia may be key. In this talk we will report some of the solutions provided by the Julia Lab at MIT and beyond.