# UNIVERSITY OF RHODE ISLAND

Department of Mathematics

## Applied Mathematics and Scientific Computing Seminar

**Location:** Lippitt Hall 205

**Time:** Thursday, November 12, 2015, 3:30pm

# A new asynchronous solver for banded linear systems

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**Abstract:** Banded linear systems occur frequently in mathematics and physics. However, direct solvers for large systems cannot be performed in parallel without communication. We will discuss a general asymmetric banded solver using a direct approach that scales across many processors efficiently. The method requires more floating point calculations than a standard solver such as $LU$ decomposition, but by leveraging multiple processors the overall solution time is reduced. We present a solver using a superposition approach that decomposes the original linear system into $q$ subproblems, where $q$ is the number of superdiagonals. Each system can be solved in parallel asynchronously, followed by a $q \times q$ constraint matrix problem that is solved before a final vectorized superposition is performed. Reduction to row echelon form is not required by the solver, and hence the method can be fast and avoids fill-in when q processors are available. The algorithm is first developed for tridiagonal and pentadiagonal problems, followed by an extension to arbitrary banded systems. In addition, accuracy and performance is compared with existing solvers as well as the next avenues for this research will be discussed.

This is joint work with Anthony Ruffa (Naval Undersea Warfare Center) and James Baglama (University of Rhode Island).