



THE UNIVERSITY OF  
CHICAGO

Departments of Computer Science, Mathematics, Statistics, and the Computation Institute  
**SCIENTIFIC AND STATISTICAL COMPUTING SEMINAR**

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## **High-Performance Computation of Pseudospectra**

**THURSDAY, October 2, 2014, at 4:30 PM**

Eckhart 133, 5734 S. University Avenue

### **ABSTRACT**

Evaluating the norm of a resolvent over a window in the complex plane provides an illuminating generalization of a scatter-plot of eigenvalues and is of obvious interest for analyzing preconditioners. Unfortunately the common perception is that such a computation is embarrassingly parallel, and so little effort has been expended towards reproducing the functionality of the premier tool for pseudospectral computation, EigTool (Wright et al.), for distributed-memory architectures in order to enable the analysis of matrices too large for workstations. This talk introduces several high-performance variations of Lui's triangularization followed by inverse iteration approach which involve parallel reduction to (quasi-)triangular or Hessenberg form followed by interleaved Implicitly Restarted Arnoldi iterations driven by multi-shift (quasi-)triangular or Hessenberg solves with many right-hand sides. Since multi-shift (quasi-)triangular solves can achieve a very high percentage of peak performance on both sequential and parallel architectures, such an approach both improves the efficiency of sequential pseudospectral computations and provides a high-performance distributed-memory scheme. Results from recent implementations within Elemental (P. et al.) will be presented for a variety of large matrices and practical convergence-monitoring schemes will be discussed.

This is joint work with Greg Henry (Intel).

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