1131-00-289 **Adrianna Gillman*** (adrianna.gillman@rice.edu). *Fast direct solvers for boundary integral equations.*

The numerical solution of linear boundary values problems play an important role in the modeling of physical phenomena. As practitioners continue to want to solve more complicated problems, it is important to develop robust and efficient numerical methods. For some linear boundary value problems, it is possible to recast the problem as an integral equation which sometimes leads to a reduction in dimensionality. The trade-off for the reduction in dimensionality is the need to solve a dense linear system. Inverting the dense $N \times N$ matrix via Gaussian elimination has computational cost of $O(N^3)$. This talk presents solution techniques that exploit the physics in the boundary integral equation to invert the dense matrix for a cost that scales linearly with N and has a small constant. For example, on a laptop computer, a matrix with $N = 100,000$ can be inverted in 90 seconds and applying the solver takes under a tenth of a second. Numerical results will illustrate the performance of the fast direct solvers for a variety applications. (Received July 17, 2017)