

TEMPLE UNIVERSITY  
Department of Mathematics

# Applied Mathematics and Scientific Computing Seminar

Room 617 Wachman Hall

Wednesday, 29 February 2012, 4:00 p.m.  
(tea at 3:45)

## Ranking network hubs and authorities using matrix functions

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### **Abstract.**

The notions of subgraph centrality and communicability, based on the exponential of the adjacency matrix of the underlying graph, have been effectively used in the analysis of undirected networks. In this paper we propose an extension of these measures to directed networks, and we apply them to the problem of ranking hubs and authorities. The extension is achieved by bipartization, i.e., the directed network is mapped onto a bipartite undirected network with twice as many nodes in order to obtain a network with a symmetric adjacency matrix. We explicitly determine the exponential of this adjacency matrix in terms of the adjacency matrix of the original, directed network, and we give an interpretation of centrality and communicability in this new context, leading to a technique for ranking hubs and authorities. The matrix exponential method for computing hubs and authorities is compared to the well known HITS algorithm, both on small artificial examples and on more realistic real-world networks. Time permitting, the use of Gaussian quadrature rules for calculating hub and authority scores will also be discussed.