

Researchers Develop Tool to Assess Supernetwork Efficiency and Vulnerability

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Natural disasters, accidents and the failure of aging equipment can have serious consequences for transportation networks, electrical power supply chains and telecommunications networks. University of Massachusetts Amherst researchers have developed a computer-based tool that identifies the most important components of these critical infrastructure networks.

The research was conducted by John M. Smith Memorial Professor Anna Nagurney, director of the Isenberg School of Management's Virtual Center for Supernetworks and doctoral student Qiang "Patrick" Qiang. Funding for the study was provided by the National Science Foundation.

The new tool is a network efficiency measure that determines the demand for network resources based on user behavior and associated costs. It also determines the loss of efficiency that occurs when key components like roads, electrical power stations or transmission lines are destroyed and captures how users of a network readjust after network disruptions.

"We expect that the tool will have wide practical applications since it provides a quantifiable way to identify which network components should be best maintained based on actual usage and costs," says Nagurney.

Policy analysts and decision-makers can use the new tool to identify the

most critical nodes and links in a network and rank them in order of importance. “The most critical network components should be the most protected since their removal will result in the greatest loss of network efficiency and have the greatest impact on the economy and society,” says Nagurney.

The first results of the study, “A Network Efficiency Measure for Congested Networks,” will be published in the August 2007 Europhysics Letters. Additional papers are in press in the journals Optimization Letters and the Journal of Global Optimization.

Nagurney has recently given talks on the results of the study in Geneva, London, Dallas, Montreal and Puerto Rico.

Source: University of Massachusetts Amherst

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