
The Supernetwork Sentinel

The Newsletter of the Virtual Center for Supernetworks

Fall 2008



Welcome to the Fall 2008 edition of **The Supernetwork Sentinel**, the newsletter of the Virtual Center for Supernetworks at the Isenberg School of Management, UMass Amherst. **The Supernetwork Sentinel** is published in Fall, Winter, and Summer editions. Its purpose is to keep you informed of events, activities, and successes of the Virtual Center for Supernetworks, the Center Associates, and the Supernetworks Laboratory for Computation and Visualization. In this newsletter, we include Professor Anna Nagurney's essay on transportation network fragility in an era of climate change. We also share information on recently received distinctions and news about exciting upcoming seminars and conferences. As always, we provide a list of our recent publications.

We wish everyone a wonderful new academic year!

Anna Nagurney
John F. Smith Memorial Professor
Director – Virtual Center for Supernetworks
<http://supernet.som.umass.edu>



Professor Nagurney with Professor Javier Reyes from the Sam Walton School of Business at the 14th Conference on Computing in Economics and Finance at the Sorbonne, June 26-28, 2008, Paris, France.



Professor Anna Nagurney with Several UMass Amherst INFORMS Student Chapter Officers and Members

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Transportation Network Fragility in an Era of Climate Change: Where Science and Engineering Must Meet Management

Professor Anna Nagurney

According to the American Society of Civil Engineers (ASCE), \$94 billion is needed in the US to repair the degradation of transportation networks due to poor maintenance, natural disasters, deterioration over time, in addition to unforeseen attacks. Moreover, in a new era of climate change, it is expected that the degradation of critical infrastructure, including transportation networks, can be expected to increase. Simultaneously, emissions generated through transportation are some of the biggest contributors to climate change and global warming. According to an EPA report, the transportation sector in 2003 accounted for 27% of the total greenhouse gas emissions and the increase in this sector was the largest of any in the period 1990 -- 2003. In addition, the energy use due to transportation is expected to increase by 48% between 2003 and 2025, regardless of the improvements in the efficiency of engines. Indeed, the impact of the degradation of transportation network infrastructure is evident. The ASCE further reports that substandard road conditions cost US motorists \$54 billion in repairs and operating costs yearly.

The degradation of roads not only impacts motorists, but also freight. A Federal Highway Administration report notes that the US is experiencing a freight capacity crisis that threatens economic productivity. The American Road & Transportation Builders Association states that nearly 75% of US freight is carried on highways and bottlenecks now cause truckers 243 million hours of delay annually with an estimated associated cost of \$8 billion. Such delays result in additional emissions that, in turn, further impact the environment and affect the deterioration of the critical road infrastructure creating a vicious cycle.

At the same time, natural disasters are increasing globally as well as the people affected by them. The period between 2000-2004 experienced an average annual number of disasters that was 55% higher than the period of 1995-1999 with 33% more people affected in the more recent period. In 2005, 157 million people required immediate assistance due to disasters as compared to approximately 150 million requiring assistance the year prior. One just needs to view the shocking images of the building and road collapses and the human suffering and deaths following the recent earthquakes in Sichuan, China, and Cyclone Nargis in Myanmar/Burma to see the impact of natural disasters on societies and their infrastructure.

What can be done? In times of limited budgets, soaring fuel and food prices, increasing climate impacts, it is essential to harness the expertise of science, engineering, and management. Alone, not one of these disciplines can solve the vicious cycle of decaying infrastructure and global climate change. We need to pool our knowledge and research expertise regarding congestion management, transportation (and other critical infrastructure) network vulnerability analysis in order to identify which are the most important roads, bridges, etc., in order to maintain and secure these more thoroughly, and transportation network robustness analysis in order to ascertain how travelers' behavior affects and responds to deteriorating network capacity.

We are in a new era and knowing what to do in terms of maintenance and preparedness, response, and reconstruction will enable us to respond dynamically when unforeseeable events occur. Education on transportation and logistics that combines the latest in analytics and quantitative analysis with a respectful role for qualitative analysis and case studies can help us to transfer lessons learned to our immediate environment and beyond.

In a number of our studies, conducted with doctoral student, Patrick Qiang, on transportation network efficiency and performance measurement, we have developed metrics that identify the critical network components, such as roads and bridges, as well as different modes of transportation, such that their removal would economically impact the transportation network efficiency the most. In addition, we have devised measures that identify road importance from an environmental perspective.

This synergistic approach to transportation networks and climate change will result in solutions that our political leaders can present and sell to our fellow citizens for our mutual benefit. We are co-authoring a book on the the general theme of this essay due to the need to be able to quantify and assess network vulnerability not only regionally and nationally but also globally.

This is an update of the essay that appeared as an invited OpEd piece in the *Daily Hampshire Gazette* on June 16, 2008.

**UMass Amherst INFORMS
Student Chapter Fall 2008
Speaker Series**



We are delighted to announce the Fall 2008 lineup. All talks take place on scheduled Fridays at 11 a.m. in Room 112 at the Isenberg School of Management and are open to the public. After each presentation, interested guests are welcome to join the speaker for additional conversation at lunch at the University Club.

- **Daron Acemoglu**, the Charles P. Kindleberger Professor of Applied Economics at MIT, will speak on "Bayesian Learning on Social Networks" (Sept. 19). Acemoglu is the 2005 John Bates Clark Medal recipient from the American Economic Association and is a fellow of the American Academy of Arts and Sciences. His talk is jointly presented with the Finance Seminar Series at the Isenberg School.

- **Grace Lin**, Chief Technology Officer and Director of Innovation and Emerging Solutions — Supply Chain Management, at IBM Global Business Services in Yorktown Heights, N.Y., (Oct. 3) will discuss "Enterprise of the Future." Lin was the leader of the IBM team that received the 1999 INFORMS Franz Edelman Award for its role in reengineering efforts that resulted in more than \$750 million in savings for IBM in 1998. She is an INFORMS Fellow. Her research has been recognized in *Forbes* and *China News*.

- **Ahmed Ghoniem**, Assistant Professor in the Department of Finance and Operations Management at the Isenberg School will speak on "Joint Vehicle Assembly-Routing Problems: An Integrated Modeling and Optimization Approach" (Oct, 24). A new faculty member at UMass Amherst, Dr. Ghoniem has degrees from Virginia Tech and the Ecole des Mines de Nantes in France. He has conducted projects with Volvo Logistics North America and Harley-Davidson.

- **Senay Solak**, Assistant Professor in the Department of Finance and Operations Management at the Isenberg School, will speak on "Air Traffic Flow Management in the Presence of Uncertainty" (Nov. 7). Dr. Solak holds

degrees from the U.S. Naval Academy and Georgia Tech and just joined the faculty of the Isenberg School. He served for seven years as a naval officer and also worked as an analyst in the planning department of the Hartsfield-Jackson International Airport in Atlanta, Georgia.

- **Tom Vanderbilt** of New York City will speak on Nov. 14. He writes about design, technology, science, and culture for *Wired*, *Slate*, *The New York Times* and other publications. His most recent book *Traffic: Why We Drive the Way We Do (and What it Says About Us)* was reviewed in *The New York Times Book Review* on Aug. 10 and has been the subject of extensive media coverage.

- **Kevin Fu**, Assistant Professor in the UMass Amherst Department of Computer Science, will discuss "Implantable Medical Devices: Security and Privacy for Pervasive, Wireless Healthcare" (Dec. 5). Dr. Fu is the Co-Director of the Medical Device Security Center and the Director of the RFID Consortium on Security and Privacy. His work has been featured in *The New York Times* and *The Wall Street Journal*. His talk will take place in Room at 128 of the Isenberg School of Management.

Support for the speaker series is provided by the Isenberg School of Management and its Department of Finance and Operations Management, the John F. Smith Memorial Fund, and INFORMS. Anna Nagurney, the John F. Smith Memorial Professor at the Isenberg School of Management, serves as the faculty advisor to the Chapter and its speaker series, which is now in its ninth semester of operation; <http://supernet.som.umass.edu/informs/speakernew.html>

The new slate of Chapter Officers for 2008-2009 is now available. Center Associate Amir Masoumi is the President; Center Associate Min Yu is the Vice President. Milad Ebtehaj is the Treasurer and Deanna Kennedy is the Secretary. Patrick Qiang, last year's Chapter President, is the webmaster. For more information about the Student Chapter, see:

<http://student.som.umass.edu/informs/>

Exciting Upcoming Conference and Seminar Presentations

The Fall 2008 semester is promising to be extremely busy with many exciting upcoming conference and seminar presentations.

Center Associate Dr. Stavros Siokos, who is the Vice President of the Piraeus Bank in Athens, Greece, will be giving several invited presentations in the coming weeks and months

at a variety of prestigious financial forums. On September 17, 2008, he will be speaking on "Algorithmic Trading and Direct Market Access," at the Fund & Structured Product Strategies Forum. On September 22, 2008, he will be speaking at the Derivatives in Emerging Markets Focus Day, in London, England, on "Increasing Your Product Range Through Derivatives in Greece." Dr. Siokos left Citigroup as a Managing Director this past year and has been with the Piraeus Bank since April 2008. His move was covered by Bloomberg.com.

On September 23, 2008, Professor Anna Nagurney will give a talk sponsored by the Center for Women in Mathematics at Smith College in Northampton, MA. The title of her presentation is, "Equilibrium Modeling and Vulnerability Analysis of Complex Network Systems: Which Nodes and Links Really Matter?"

October 10-12, 2008, Professor Anna Nagurney will be taking part in the "Workshop on Frontiers in Game Theory and Networked Control Systems" at MIT in Cambridge, MA. This conference is being sponsored by the Department of Electrical Engineering and Computer Science at MIT, the Army Research Office, and the National Science Foundation. Her invited talk is entitled, "To Merge or Not to Merge: Multimarket Supply Chain Network Oligopolies, Coalitions, and the Merger Paradox." The link to the MIT conference website is: <http://games.lids.mit.edu/>

The Center Associates will be giving many presentations at the INFORMS National Meeting in Washington, DC, October 12-15, 2008. Professor Anna Nagurney has organized two sessions for this meeting as part of the Transportation Science & Logistics Society track. The titles of the sessions are: "Transportation and Climate Change" and "Transportation Network Vulnerability and Performance Assessment." More information on this conference, including the complete program, can be found at: <http://meetings.informs.org/DC08/>

On October 31, 2008, Professor Anna Nagurney is scheduled to be a speaker in the 2008 Fogelman College Distinguished Speaker Series at the University of Memphis. She is very much looking forward to her visit to the University of Memphis. One of her hosts will be Center Associate Professor Tina Wakolbinger. More information can be found at: <http://supernet.som.umass.edu/media/media.htm>

The 55th Annual North American Meetings of the Regional Science Association International will take place November 19-22, 2008, in Brooklyn, New York. Professor Anna Nagurney has accepted an invitation to give a plenary talk at this conference. The website for the conference is at: <http://narsc.org/conference.html>

The 11th INFORMS Computing Society Conference will take place January 11-13, 2009 in Charleston, South Carolina. The theme of this biannual conference is *Operations Research and Cyberinfrastructure*. The website for the conference: <http://ics09.meetings.informs.org/>

Kudos and News

Dr. Zugang "Leo" Liu received his PhD in Business Administration with a major in Management Science from UMass Amherst in May 2008. He is now an Assistant Professor at Penn State University in Hazleton. He is enjoying teaching and also regularly travels to the main Penn State campus for meetings at the Smeal School of Business.



Center Associate Dr. Zugang "Leo" Liu at the 2008 University of Massachusetts Graduate Commencement

The "Humanitarian Logistics: Networks for Africa" Conference, which was organized by Professor Anna Nagurney under the auspices of the Rockefeller Foundation Bellagio Center Programs, took place May 5-9, 2008 at the Bellagio Center on Lake Como in Italy. The conference was the subject of a feature article in the *CSIR eNews* a publication of The Council for Scientific and Industrial Research in South Africa. One of the invited participants in the conference was CSIR Fellow Mr. Antony Cooper. The article is available at: <http://hlogistics.som.umass.edu/csir-eneews.htm>

On June 4, 2008, Professor Anna Nagurney conducted a short course at the World Bank in Washington, DC, on Network Economics. This course was part of a three day course on Geographic Information Systems (GIS) and Spatial Economics in World Bank Projects. Her lecture slides are available at: <http://supernet.som.umass.edu/visuals.html>

Professor Anna Nagurney delivered the paper, "Environmental Impact Assessment of Transportation Networks with Degradable Links in an Era of Climate Change," co-authored with

Center Associates, Qiang "Patrick" Qiang and Professor Ladimer Nagurney at the Third International Conference on Financing Transport Infrastructure, in La Defense, Paris, France, June 19-20, 2008.



Professors Anna and Ladimer Nagurney at La Defense, Paris, France, June 2008

In addition, Professor Anna Nagurney presented the paper, "An Integrated Electric Power Supply Chain and Fuel Market Network Framework: Theoretical Modeling with Empirical Analysis for New England," co-authored with Center Associate, Dr. Zungang "Leo" Liu, at the 14th Conference on Computing in Economics and Finance, June 26-28, 2008, in Paris, France.

In August, Center Associate Professor June Dong of the School of Business at SUNY Oswego traveled to Shanghai, China. She gave an invited talk, "Recent Developments and Applications in Supernetworks" at the University of Shanghai for Science and Technology (USST). She was hosted by Professor Bingquan Fan of USST.

Center Associate, Dr. Ke "Grace" Ke, has left the School of Business at the University of Arkansas in Monticello and is now an Assistant Professor in the Department of Finance and Operations and Supply Chain Management at the School of Business at Central Washington University. She will be based at the Seattle campus. Her husband, Dr. Haizheng Zhang, is employed by Microsoft. Congratulations to Dr. Ke!

Center Associate Professor Ladimer Nagurney of the University of Hartford is enjoying his sabbatical this academic year. He is a Visiting Research Associate Professor of Electrical and Computer Engineering at UMass Amherst and is being hosted by CASA, the Center for the Adaptive Sensing of the Atmosphere. The Director of the Center is Professor David McLaughlin. In addition, he will be presenting a paper, joint with Professor Hisham Alnajjar, "The Five Paragraph Essay in Junior/Senior Electrical Engineering Courses," at the Frontiers in Engineering Education Conference in Saratoga Springs, NY in October 2008.

Congratulations to Center Associate Trisha Woolley who has been selected to participate in

the Future Academicians Colloquium to be held prior to the INFORMS National Meeting in Washington, DC, October 12-15, 2008; <http://meetings.informs.org/DC08/>

Congratulations to Center Associate Professor Ding Zhang, who is the MBA Director at the School of Business at SUNY Oswego! His paper, joint with Professor Fan Yang, entitled: **Day to Day Stationary Link Flow Pattern**, is in press in the journal *Transportation Research B*.

Congratulations to Center Associates Professors Jose M. Cruz and Tina Wakolbinger! Their paper: **Multiperiod Effects of Corporate Social Responsibility on Supply Chain Networks, Transaction Costs, Emissions, and Risk**, has been accepted for publication in the *International Journal of Production Economics*. In addition, Professor Cruz's paper, joint with Professor Dmytro Matsypura of the University of Sydney, entitled: **Supply Chain Networks with Corporate Social Responsibility Through Integrated Decision-Making**, has been accepted for publication in the *International Journal of Production Research*.

Center Associates were engaged this summer with many professional service-related activities. Professor Anna Nagurney served on the INFORMS Search Committee for the Editor-in-Chief of the journal *Transportation Science*. She was also very busy reviewing many proposals from international scientific agencies as well as journal articles. Center Associates are always involved in journal reviewing since the research on supernetworks has captured the interest of researchers in many disciplines and from many countries.

Center Associate Professor Tina Wakolbinger continues to serve as Junior Vice President of Communications of WORMS (Women in Operations Research and the Management Sciences); <http://worms.forum.informs.org/>

The Center Director, Professor Anna Nagurney, would like to officially welcome two new Doctoral Student Center Associates: Mr. Amir Masoumi and Ms. Min Yu. Both have degrees in engineering and are now enrolled in the doctoral program in Business Administration with a concentration in Management Science at the Isenberg School of Management. Welcome!

For more information on the talks, conferences, and upcoming events, see: <http://supernet.som.umass.edu/conferences.html>



Luncheon for the Advisory Council of the Society for Computational Economics during the Computing in Economics and Finance Conference in Paris, France, June 2008

Recent Center Publications

Copies of these (and other) center articles are at: <http://supernet.som.umass.edu/dart.html>

Multiperiod Effects of Corporate Social Responsibility on Supply Chain Networks, Transaction Costs, Emissions, and Risk, J. M. Cruz and T. Wakolbinger (2008), to appear in the *International Journal of Production Economics*.

Modeling of Supply Chain Risk Under Disruptions with Performance Measurement and Robustness Analysis, Q. Qiang, A. Nagurney, and J. Dong (2008), invited chapter for *Managing Supply Chain Risk and Vulnerability: Tools and Methods for Supply Chain Decision Makers*, T. Wu and J. Blackhurst, Editors, Springer.

Networks in Finance, A. Nagurney (2008), in the *Handbook on Information Technology and Finance*, D. Seese, C. Weinhardt, F. Schlottmann, Editors, Springer, Berlin, Germany, pp. 383-420.

A Relative Total Cost Index for the Evaluation of Transportation Network Robustness in the Presence of Degradable Links and Alternative Travel Behavior, A. Nagurney and Q. Qiang (2008), to appear in the *International Transactions of Operational Research*.

Spatially Differentiated Trade of Permits for Multipollutant Electric Power Supply Chains, T. Woolley, A. Nagurney, and J. K. Stranlund, to appear in *Optimization in the Energy Industry*, K. Kallrath, P. Pardalos, S. Rebennack, and M. Schei, Editors, Springer, Berlin, Germany.

The Five Paragraph Essay in Junior/Senior Electrical Engineering Courses, L. S. Nagurney and H. Alnajjar, to appear in the

Proceedings FIE'08, D. Budny, Editor, IEEE, Saratoga Springs, NY, 2008.

A System-Optimization Perspective for Supply Chain Network Integration: The Horizontal Merger Case, A. Nagurney, *Transportation Research E* (2008), in press.

Identification of Critical Nodes and Links in Financial Networks with Intermediation and Electronic Transactions, A. Nagurney and Q. Qiang, in *Computational Methods in Financial Engineering*, E. J. Kontoghiorghe, B. Rustem, and P. Winker, Editors, Springer, Berlin, Germany (2008), pp. 273-297.

A Unified Network Performance Measure with Importance Identification and the Ranking of Network Components, Q. Qiang and A. Nagurney, *Optimization Letters* (2008), 2, pp. 127-142.

A Network Equilibrium Framework for Internet Advertising: Models, Qualitative Analysis, and Algorithms, L. Zhao and A. Nagurney, *European Journal of Operational Research* (2008), 187, pp. 456-472.

Dynamics of Supply Chain Networks with Corporate Social Responsibility Through Integrated Environmental Decision-Making, Jose M. Cruz, *European Journal of Operational Research* (2008), 184, pp. 1005-1031.

A Network Efficiency Measure with Application to Critical Infrastructure Networks, A. Nagurney and Q. Qiang, *Journal of Global Optimization* (2008), 40, pp. 261-275.

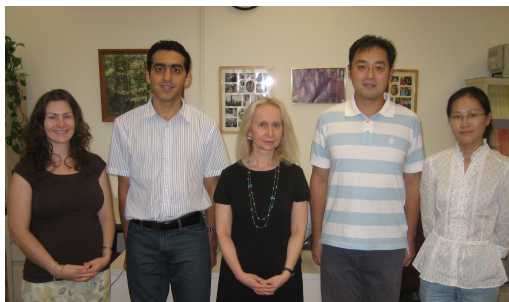
An Efficiency Measure for Dynamic Networks with Application to the Internet and Vulnerability Analysis, A. Nagurney and Q. Qiang, *Netnomics*, published online by Springer on March 19, 2008.

Environmental Impact Assessment of Transportation Networks with Degradable Links in an Era of Climate Change, A. Nagurney, Q. Qiang, and L. Nagurney (2008), submitted.

An Integrated Framework for the Design of Optimal Web Banners, L. Hai, L. Zhao, and A. Nagurney (2008), submitted.

Environmental and Cost Synergy in Supply Chain Network Integration in Mergers and Acquisitions, A. Nagurney and T. Woolley (2008), submitted.

An Integrated Electric Power Supply Chain and Fuel Market Network Framework: Theoretical Modeling with Empirical Analysis for New England, Z. Liu and A. Nagurney (2008), revised and submitted.



**Professor Nagurney and Doctoral Student
Center Associates**

September 2008

**The Center Director, Professor
Anna Nagurney, and the Center
Associates thank you for your
support!**

**Virtual Center for Supernetworks
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Dr. June Dong
Dr. Ke "Grace" Ke
Dr. Zungang "Leo" Liu
Dr. Ladimer Nagurney
Dr. Padma Ramanujam
Dr. Stavros Siokos
Dr. Tina Wakolbinger
Dr. Ding Zhang

Doctoral Students

Amir Masoumi
Qiang "Patrick" Qiang
Trisha Woolley
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If you would like to be put on our email list,
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