

# Networking as a Tool for Career Progression

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**WISDOM Panel, EURO Copenhagen, June 30, 2024**

Many thanks to WISDOM for this interesting panel and for bringing us together. Special thanks to Professor Paula Carroll for the invitation to speak with you.

**WISDOM**

WOMEN IN SOCIETY:  
DOING OPERATIONAL RESEARCH  
AND MANAGEMENT SCIENCE

# Outline of This Presentation

- ▶ **On Being an Operations Researcher**
- ▶ **Early in One's Career**
- ▶ **Networking in Mid-Career**
- ▶ **Networking with Journalists and Decision-Makers**
- ▶ **Giving Back and Mentoring Through Networking**

# On Being an Operations Researcher

# On Being an Operations Researcher

Conducting research and teaching are a passion and no two days are ever alike!

**Everyone should have an opportunity to explore science and to become a scientist to explore our beautiful world and to add to knowledge discovery.**



**Intellectual curiosity and creativity underly what we do. We care about making a positive impact on our world.**

# On Being an Operations Researcher

I use mathematics and tools of operations research (OR) to enhance our understanding of network systems in which humans interact with infrastructure.



**Networking is very natural to me since I study networks.**

**Networking enables the sharing of ideas and information, helps to build skills, expertise, and confidence, forges and strengthens professional relationships, and unveils new opportunities.**

A great professional society, such as INFORMS or the Operational Research Society, as well as fora such as WISDOM and WORMS are outstanding platforms for networking, at all stages of one's career in Operations Research and Analytics.

**Networking takes different forms whether you are a student, an early career professional, a mid-career one, or even senior.**

**Networking can enrich you professionally as well as personally and provide advice as well as support.**

# For the Love of **Operations Research (OR)** and **Networks**

From my first course at Brown University on the subject to my first projects in industry - working on naval submarines in Newport, Rhode Island, I was drawn to the power of networks, especially when combined with computing.



# Off to Grad School for a PhD

While working in high tech defense consulting I very soon I realized that I did not like having a boss. I commuted, ran marathons, and worked full time while taking courses for my Master's at Brown.

Dr. Stella Dafermos was the only female professor at the time in either Engineering or Applied Mathematics at Brown University. I became her first PhD student.



Anna Nagurny



## EQUILIBRIUM MODELING, ANALYSIS AND COMPUTATION: THE CONTRIBUTIONS OF STELLA DAFERMOS

ANNA NAGURNY

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Revised June 1993, accepted August 1993

This preface refers to the late Stella Dafermos' contributions to equilibrium modeling, analysis, and computation, and provides a list of her published papers.

On April 5, 1990, with the death at 48 of Stella Dafermos, Professor of Applied Mathematics and Engineering at Brown University, Providence, Rhode Island, the operations research community lost one of its early women deans. Throughout her quarter-century career she dedicated herself to developing rigorous mathematical foundations for modeling, analyzing and making computations related to competitive equilibrium systems that spawned applications from congested urban transportation networks to radiofrequency trade. Beginning with her PhD doctoral dissertation, "Traffic Assignment and Resource Allocation in Transportation Networks," directed by F. F. Squarzo at Johns Hopkins University, which focused on the study of system-optimal and user-optimal transportation networks, she initiated a theme of advancement of methodologies by which the behavior of complex systems could be opened and studied.

### EQUILIBRIUM MODELING

In her first paper, based on her thesis and published in 1962, she proposed convergent equilibrium algorithms that simulated the adjustment behavior of travelers on a congested network operating in their own self-interest in choosing their routes. The general equilibrium conditions, due to Wardrop, reflected that only the minimum cost routes connecting each origin-destination pair would be used. These algorithms took advantage of the problem structure and were later extended in papers published in 1971 and 1972 to network models that allowed for interaction among users of the system via the link cost functions. In her 1969 paper she also focused on stability issues, which began the theme of qualitative analysis of equilibrium patterns that was also to pervade her scholarly work.

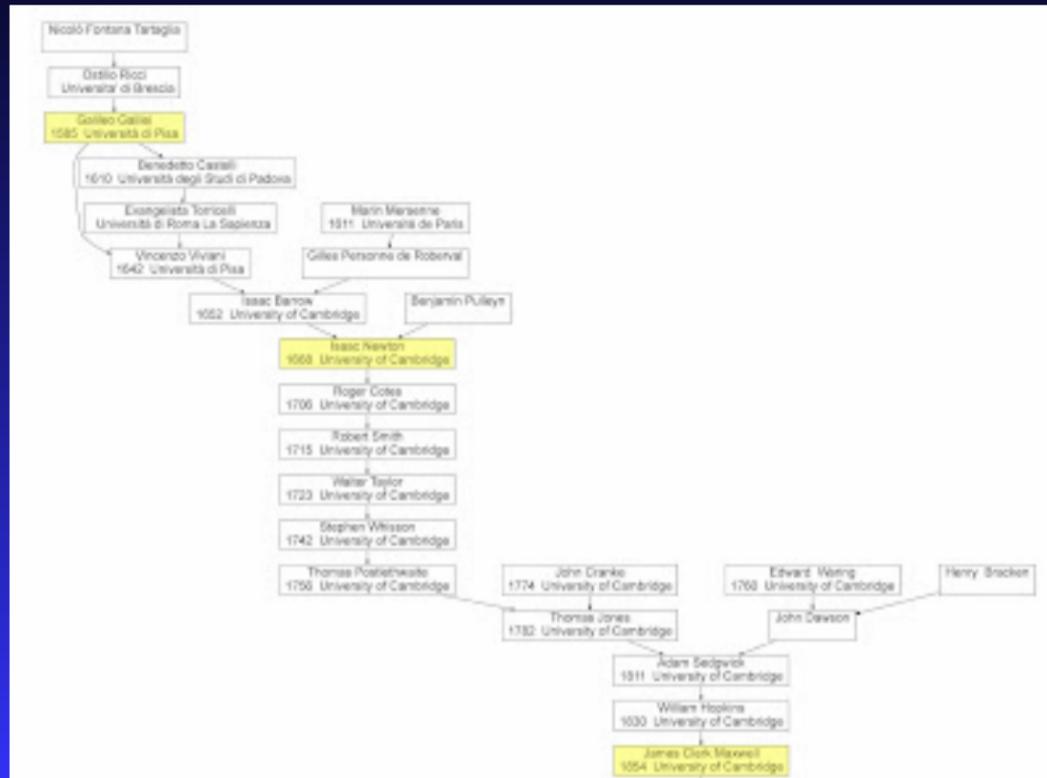
These network equilibrium models, as well as the integrated models that allowed for both location and

route choice, developed in her paper of 1976, were formalized as optimization problems, with the observation that the equilibrium conditions governing these problems were actually the Karush-Tucker conditions of an appropriately constructed optimization problem. Intriguingly, parallel to these developments in nonlinear networks, the economics community was reformulating spatial price equilibrium problems, in which commodities are produced, consumed and traded, subject to transportation of transaction costs, as optimization problems. However, the assumption required for such a transformation—that of symmetry, in which cross-effects of various interactions had to be identical—precluded the realistic modeling of multiple modes of transportation and different classes of users of a given system, as well as multiple commodities. Moreover, the objective function thus constructed, although convenient and essential given the state-of-the-art at the time, was artificial. Furthermore, equilibrium problems, by their very nature, involve more than a single agent and objective function, with interactions among the agents, and, hence, the objective functions being the role rather than the exception. To overcome such shortcomings, a methodological advance was needed.

In 1980 Stella made a fundamental discovery by observing that the equilibrium conditions of the traffic assignment problem actually had the structure of a variational inequality problem. Although the theory of variational inequalities had been formulated over a decade earlier for the study of partial differential equations, the emphasis there was on infinite-dimensional problems arising in mechanics, and its use as a powerful tool for equilibrium analysis in operations research was left unexplored. Stella's identification of network equilibrium conditions with a variational inequality problem opened up new horizons for mathematical modeling, analysis and the efficient computation of more general equilibrium systems than had heretofore been possible. With this

Networking

# On the Shoulders of Giants - My Academic Genealogy - Maxwell, Newton, and Galileo



# Books



# Early in One's Career

## Early in One's Career

I am sure that everyone remembers one's first conference, as an attendee and/or presenter, and the excitement and anticipation. The venue may have been stunning (or less than so). The conferees that one met then and the shared experiences and conversations at conferences since have become part of your social and professional capital.

As an eager conferee, I was always hungry for advice, and, at every opportunity, would approach senior colleagues, whose work I had appreciated and learned much from, at conferences.

## Early in One's Career

I would often ask, “What advice can you give me for professional success?” and the response would often be to “grow your network.”

That could entail, as an educator, investing in students, both undergraduates and graduate ones, including PhD students, but, also, the nurturing of new collaborations and partnerships for a wide range of professional activities, from conducting research and publishing to doing service.

Having common interests helped to build stronger relationships and to enhance both existing networks as well as to grow or establish new ones. And, importantly, working with others, made for more enjoyable and effective professional endeavors.

## Our Fabulous **Scientific** Community



After I received my PhD, I met **Professor George Dantzig of Stanford University**, the developer of the simplex method and a Father of OR!

**He came to the first presentation that I ever gave at a conference, post PhD, and it was at the Mathematical Programming Symposium at MIT.**

# Places that OR May Take You as You Grow Your Networks

Yalta, Ukraine with my taxi driver Igor



Buenos Aires, Argentina and the Blue Lagoon in Reykjavik, Iceland



# Places that OR May Take You

## Italy and Switzerland



## Oxford University and Imperial College



Anna Nagurney

Networking

# Places that OR May Take You

## Radcliffe Institute for Advanced Study at Harvard University



## Congreso Futuro, Chile!



## Early in One's Career

Early on in my academic year - and I have always also had a foot in practice, since I had worked for several years in high tech consulting and software engineering in the defense sector and enjoyed such work tremendously - I took advantage of various INFORMS society memberships.

Joining, for example, the Transportation and Logistics Society of INFORMS, the Computing Society of INFORMS, as well as the Practice Section, and MSOM, and taking part in business meetings at conferences, enabled me to meet thought leaders and highly successful experts, from around the globe.

I benefited from newsletters, special focused conferences, and even e-lists with information of job openings and other opportunities.

## Early in One's Career

The **WORMS** lunches at **INFORMS** conferences are where, pre-pandemic and post-pandemic, many of my former PhD students would be sure to gather, and where we enjoyed the camaraderie, getting re-energized, meeting new folks, and also hearing about various recipients of awards!



**WISDOM** now plays an excellent role in support of females and networking!

# Networking in Mid-Career

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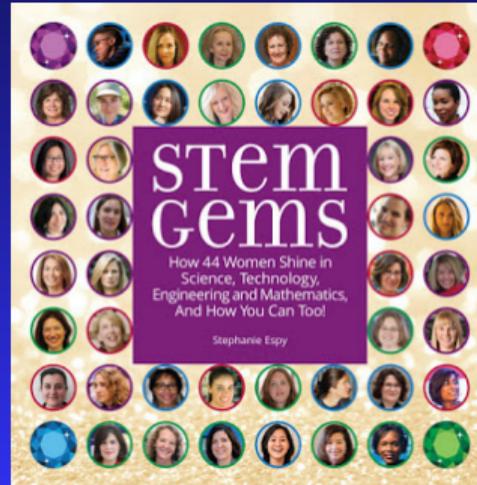
Mid-career, networking continues to be essential, with staying current and enhancing one's skills and professional portfolio, of high relevance and importance.



As the Faculty Advisor to the UMass Amherst INFORMS Student Chapter, we have been honored to host many luminaries in our field, both practitioners as well as academics.

# Networking in Mid-Career

In mid-career, one often assumes additional leadership roles, which open up many possibilities, based on one's interests and time budget. One can “run for office,” serve on various committees, according to one's interests, be invited to serve on editorial boards or award committees, be an advocate for the profession, and, of course, also give back and mentor.



# Networking with Journalists and Decision-Makers

# Networking with Journalists and Decision-Makers

## Writing OpEds

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Academic opinion, journalistic flair

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### How disaster relief efforts could be improved with game theory

March 6, 2017 11:29am EDT



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**Disclosure statement**

Anna Nagurny does not work for, consult, own shares in or receive funding from any company or organization that would benefit from this article, and has declared no relevant financial interest beyond the academic appointment above.

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**UMASS AMHERST**  
University of Massachusetts Amherst provides funding as a leading partner of The Conversation Ltd.

**Photo** The number of disasters has doubled globally since the 1980s, with the

**Chicago Tribune**

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### Response to natural disasters like Harvey could be helped with game theory

By **Anna Nagurny**  
University of Massachusetts Amherst

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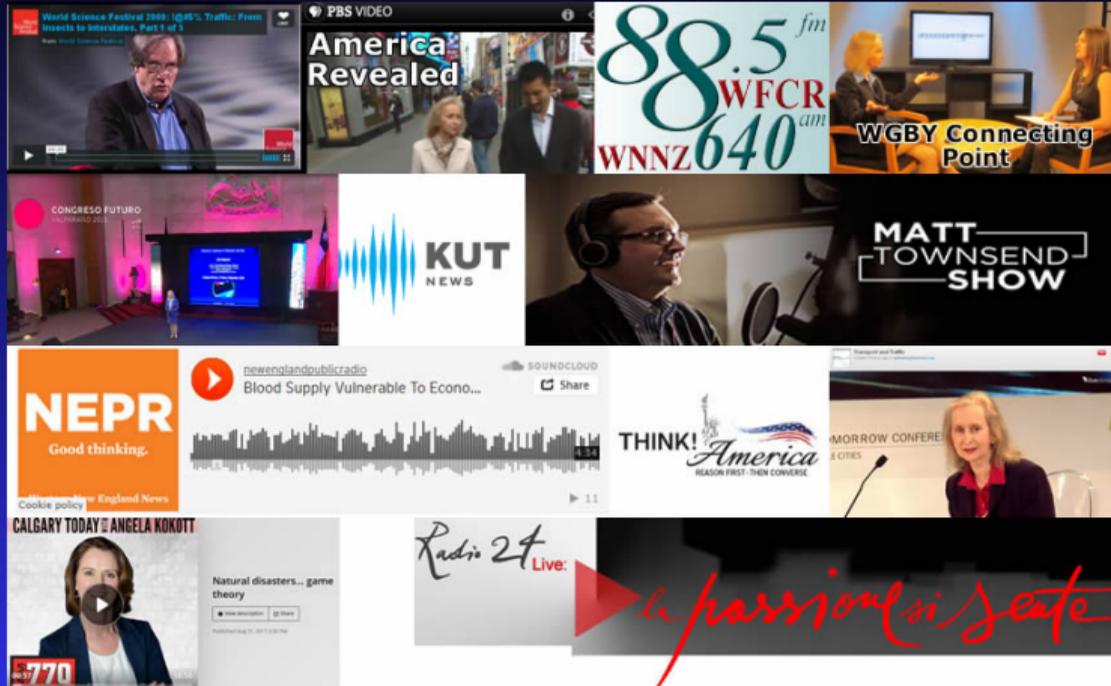
From The Conversation, University of Massachusetts Amherst

**SALON** VIDEO NEWS POLITICS ENTERTAINMENT LIFE

THURSDAY, AUG 31, 2017 10:38 AM EST

### Time for some game theory: How responses to natural disasters like Harvey could be improved

# Coverage by the Media



# Some of My Media Interviews in the Pandemic



# Some of the Media Interviews on the War on Ukraine

## Economic dangers from Russia's invasion ripple across globe

By PAUL WISEMAN and DAVID McHUGH March 2, 2022

**Fds** Feedstuffs went live.  
March 16 at 2:00 pm

The war in Ukraine is no longer just a story about a conflict between nations. It's having an immedi...  
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**NEWSTALK 1010** Anna Nagurney with John Moore

**The John Batchelor Show**

1/2: #Ukraine: The Kyiv School of Economics is open for business under fire. Paul Gregory @HooverInst @PaulR\_Gregory. Anna Nagurney @Supernetworks, University of Massachusetts. Paul Becker, Duke University

## 'I fear a cultural genocide'; Ukrainians in Western Mass. watch, worry and help

Published: Feb. 28, 2022, 5:55 p.m.



## Russian war in world's 'breadbasket' threatens food supply

By JOSEPH WILSON, SAMY MAGDY, AYA BATRAWY and CHINEDU ASADU March 6, 2022

## Threat of Russian cyber attacks likely for not just Ukraine, but also in the US

### No Ikea Shelves, No Levis: The Retail Exodus From Russia Is On

Since the invasion of Ukraine began, the increasing financial and reputational risks of doing business in Russia are leading Western brands to halt operations.

### Russian Sanctions Snarl Shipping Even as Pandemic Pressure Eases

**TC** March 11, 2022  
Liz Alderman and Jerry Gross

# Giving Back and Mentoring Through Networking

# Giving Back and Mentoring Through Networking

**We can accomplish so much more by supporting one another and working together.**

**Typically, one, early on, networks laterally and “up,” and, as time passes, it is critical to give back and to nurture and mentor others. There are tremendous advantages to this for all parties concerned.**

# Giving Back and Mentoring Through Networking

**Those who are mentored learn from the experiences and advice of others, and benefit from the positive support.**

**Those who mentor others and advocate help to grow the profession (and perhaps even one's organization) and one's present and future networks.**

The mentor also gains personally and professionally from helping out and learns from more junior constituents.

**Plus, one gets tremendous pleasure from seeing mentees succeed and shares in the happiness!**

# Being a Part of a Community Can Help in Overcoming Challenges

**A professional society can also provide its members valuable support and networking opportunities at different stages of their professional careers and, for this, and the friendships made and the memories, I am very grateful.**



**How Do I Build  
a Professional  
Network with the  
Help of INFORMS?**

Anna Nagurney, University  
of Massachusetts Amherst



# It's All About People!



Anna Nagurny

Networking

# Thank you very much!



## The Virtual Center for Supernetworks



*Supernetworks for Optimal Decision-Making and Improving the Global Quality of Life*

Director's Welcome	About the Director	Projects		Center Associates	Media Coverage	Braess Paradox
Downloadable Articles	Visuals	Audio/Video	Books	Commentaries & OpEds	The Supernetwork Sentinel	Congratulations & Kudos



**The Virtual Center for Supernetworks** is an interdisciplinary center at the Isenberg School of Management that advances knowledge on large-scale networks and integrates operations research and management science, engineering, and economics. Its Director is Dr. Anna Nagurney, the Eugene M. Isenberg Chair in Integrative Studies.

**Mission:** The Virtual Center for Supernetworks fosters the study and application of supernetworks and serves as a resource on networks ranging from transportation and logistics, including supply chains, and the Internet, to a spectrum of economic networks.

**The Applications of Supernetworks Include:** decision-making, optimization, and game theory; supply chain management; critical infrastructure from transportation to electric power networks; financial networks; knowledge and social networks; energy, the environment, and sustainability; cybersecurity; Future Internet Architectures; risk management; network vulnerability, resiliency, and performance metrics; humanitarian logistics and healthcare.

Announcements and Notes	Photos of Center Activities	Photos of Network Innovators	Friends of the Center	Course Lectures	Fulbright Lectures	UMass Amherst INFORMS Student Chapter
Professor Anna Nagurney's Blog	Network Classics	Doctoral Dissertations	Conferences	Journals	Societies	Archive

**Announcements and Notes from the Center Director**  
**Professor Anna Nagurney**  
 Updated: May 23, 2024

**Professor Anna Nagurney's Blog**  
 RENEW  
 Research, Education, Networks, and the World: A Female Professor Speaks

**Sustaining the Supply Chain**  
 We often challenge to go from Point A to Point B in normal circumstances but after a disaster it can be quite complex to get there. **Mathematical Moments Podcast** explores the model and the challenges of disaster recovery after a disaster. **Mathematical Moments Podcast** is a series of podcasts that explore the challenges of disaster recovery in the research and advanced needs of the organization.

**PBS VIDEO**  
**America Revealed**

**Competing on Supply Chain Quality**  
 Dynamics of Disasters—Key Concepts, Models, Algorithms, and Insights  
**New Books**

**Photos of Center Activities**

**The Braess Paradox Translation Information Photos**

**Publications**  
 On a Paradox of Traffic Planning  
 Environmental Impact Assessment of Transportation Networks with Degradable Links in an Era of Climate Change  
 See Nagurney's "Queue Games" and Leifson & Nagurney"