

IEEE Transactions on Network Science and Engineering

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IT gives me great pleasure to present the inaugural issue of the *IEEE Transactions on Network Science and Engineering*, a hybrid, peer-reviewed publication for an interdisciplinary study of the science and engineering of networks and networked systems. I hope this new Transactions will appeal to a broad, multi-disciplinary audience of academics, scholars, and practitioners across a broad spectrum.

It is not an exaggeration to claim that our lives are now networked on multiple levels, and no aspect of our modern activities has been spared from influence of networks or networked systems. From the Internet to the power grid and networks of digital objects, from transportation networks to interbank lending networks and social networks, we are surrounded by networked interactions of various kinds. Large-scale interconnected systems are everywhere around us, creating many services and producing massive amounts of data. While such technology has spawned no shortage of powerful and fascinating products and services that now pervade much of contemporary life, these developments have now run ahead of the science.

Ideas and methods from electrical engineering, computer science, economics, mathematics, sociology, biology, operations research, and many other disciplines are all relevant for understanding not only modern network science and engineering, but for the social forces that it drives and harnesses, and how those same forces in turn reshape the technology. However, each of these fields on their own, in their “traditional” forms, is inadequate as the basis for the new science and engineering that is required for a deep understanding of the networked landscape around us. This has led to the creation of a vibrant multidisciplinary research community that has been built around the topic, covering a large domain involving researchers from graph theory to dynamical systems, from computer science to statistical physics, from communications and information theory to control theory and signal processing, and from biological networks to economics and sociology.

The early vision of Network Science was predicated on the idea that once “universal laws” governing networks were found and understood, domain-specific details could be all but ignored, and that everything one needs to know could thus be abstracted to graph-theoretical characterizations, random or otherwise, and their associated statistics. Although this view has generated an extensive literature over the past 10 years, the limitations of this static view have also become apparent. As the field has advanced, it has now become clear that ultimately, the new tools and methods need to be combined with mathematical rigor, sound empirical methodologies, and domain-specific expertise.

This is precisely what we strive for in *TNSE*. My vision for the Transactions, which is shared by my colleagues on the Editorial Board, is to create a multidisciplinary venue that serves as the focal point for scholarly articles on Network Science and Engineering, covering rigorous theoretical, algorithmic, and experimental approaches to domain-dependent modeling, analyses, and synthesis of networked systems. The domains range from biological networks to socio-technical, and from technological and infrastructure networks to financial and economic networks.

It is my pleasure to introduce the Transactions Editorial Board members, comprised of many of the experts that have been at the forefront of creation of this (still) young discipline. The (still growing) board consists of experts on all aspects of network science and engineering and consists of individuals from all over the globe who have had a stellar research record as well as a dedication to serve the community.

Senior Editors/Editors at Large

1. **Mauricio Barahona (biological networks)** received the PhD degree in theoretical physics (dynamical systems) from the Massachusetts Institute of Technology. He is the Chair in Biomathematics in the Department of Mathematics at Imperial College London, where he has been since 2001. He was then awarded a MEC postdoctoral Fellowship at Stanford University, followed by the Edison International Fellowship at the California Institute of Technology. He is broadly interested in applied mathematics in engineering, physical, social and biological systems using methods from graph theory, stochastic processes and dynamical systems. He has applied such methods to consensus and synchronization in biology and engineering, and to the development of dynamics-based methods for community detection in networks. Other work includes algorithms for nonlinear signal analysis and geometric nonlinear projection of high-dimensional data, as well as graph-theoretical analyses of multiscale dynamics and model reduction of biosystems. Among other awards, he has been the recipient of a Fulbright Fellowship and the Whitaker prize of the Biomedical Engineering Society.

1. **Larry Blume (Economic Theory, Network Economics)** received the BA degree in economics from Washington University and the PhD degree in economics from the University of California, Berkeley. He is a Goldwin Smith professor of economics and information sciences at Cornell University. He is a visiting research professor at IHS and a member of the external faculty at the Santa Fe Institute, where he has served as a co-director of the Economics Program and on the Institute's steering committee. He teaches and conducts research in general equilibrium theory and game theory, and also has research projects on natural resource management and network design. A fellow of the Econometric Society, Blume was one of the general editors of *The New Palgrave Dictionary of Economics*, second edition, to which he contributed several articles on economic theory. He has been one of the pioneers of introducing network theory in Microeconomic theory.
2. **Babak Hassibi (Information, Social, Communications, Cyberphysical networks)** received the PhD degree in electrical engineering from Stanford University. He is the Gordon M. Binder/Amgen professor and an executive officer of electrical engineering at the California Institute of Technology, where he has been since 2001. From 1998 to 2001, he was a member of the technical staff at the Mathematical Sciences Research Center at Bell Laboratories, Murray Hill, NJ. His research interests span different aspects of communications, signal processing and control. Among other awards, he received the David and Lucille Packard Foundation Fellowship, and the Presidential Early Career Award for Scientists and Engineers (PECASE) as well as Best Paper Awards at IEEE CDC. His research interests include network information theory, signal processing, and applications of mathematics to social, technological, and information networks.
3. **Steven Low (Communication Networks, Cyber-Physical Systems)** received the BS degree from Cornell and the PhD degree from Berkeley, both in EE. He is a professor at the Computing & Mathematical Sciences and Electrical Engineering Departments, Caltech, and an adjunct professor of both the Swinburne University, Australia, and the Shanghai Jiao Tong University, China. He co-received several IEEE Best Paper Awards, the R&D 100 Award, an Okawa Foundation Research Grant, and was on the editorial boards of major networking, control, and communications journals. He is a fellow of the IEEE.
4. **Fernando Paganini (Peer to Peer Networks, Dynamics, Internet)** received the electrical engineering and mathematics degrees from Universidad de la República, Uruguay, in 1990, and the MS and PhD degrees in 1992 and 1996, respectively, in electrical engineering from Caltech, Pasadena, CA. From 1996 to 1997, he was a postdoctoral associate at MIT. From 1997 to 2005, he was on the Faculty at the UCLA Electrical Engineering Department, reaching the rank of associate professor. Since 2005, he has been a professor of engineering at Universidad ORT, Uruguay. He received the 1995 O. Hugo Schuck Best Paper Award, the Caltech 1996 Wilts and Clauser Prizes for his PhD Thesis, the 1999 US National Science Foundation (NSF) CAREER Award, the 1999 Packard Fellowship, the 2004 George S. Axelby Award, and the 2010 Elsevier Scopus Prize. He has held editorial positions in the *IEEE/ACM Transactions on Networking* and the *IEEE Transactions on Automatic Control*. He is a member of the Uruguayan National Academy of Sciences and a fellow of the IEEE. His research interests include control and networks.

Associate Editors

1. **David Alderson** received the undergraduate degree from Princeton University and the doctorate from Stanford University. He is an associate professor in the Operations Research Department and serves as the director for the Center for Infrastructure Defense at the Naval Postgraduate School (NPS). He is also a member of the NPS Cyber Academic Group, which has academic oversight of interdisciplinary cyber curricula on campus. His research focuses on the function and operation of critical infrastructures, with particular emphasis on how to invest limited resources to ensure efficient and resilient performance in the face of accidents, failures, natural disasters, or deliberate attacks. His research explores tradeoffs between efficiency, complexity, and fragility in a wide variety of public and private cyber-physical systems. He has held research positions at the California Institute of Technology (Caltech), the University of California Los Angeles, the Xerox Palo Alto Research Center (PARC), and the Santa Fe Institute. He has extensive industry experience and has worked for several venture-back startup companies. His early career was spent developing technology at Goldman Sachs & Co. in New York City.
2. **Vivek Borkar** received the BTech degree in EE from the Indian Institute of Technology, Mumbai, in 1976, the MS degree in systems and control from Case Western Reserve University in 1977, and the PhD degree in EECS from the University of California, Berkeley, in 1980. He has held positions in TIFR Centre for Applicable Mathematics and the Indian Institute of Science in Bangalore, and Tata Institute of Fundamental Research and the Indian Institute of Technology in Mumbai. He is currently the Institute chair professor of electrical engineering at IIT, Mumbai. He has held visiting positions at the University of Twente, MIT, University of Maryland at College Park, University of California at Berkeley, and University of Illinois at Urbana-Champaign. His honors include the Best Paper Award of IEEE Control Systems Society in 1982, the Homi Bhabha and J.C. Bose Fellowships, the S.S. Bhatnagar Award and TWAS Award in engineering sciences, and the Mahalanobis Medal of the Indian National Science Academy. He was an invited speaker in the control and optimization section of the International Congress of Mathematicians, Madrid, 2006. He has authored or coauthored six books and over 130 archival articles. He has served on the editorial boards of *SIAM Journal Control and Optimization*, *Systems and Control Letters*, *Sadhana* (Proc. Ind. Acad. Sci. for engineering sciences), *Ramanujan Math. Journal*, *Indian J. Pure and Appl. Math.*, *IEEE Trans. Information Theory*, and *Appl.*

Mathematicae (Polish Acad. Sci.). His interests are in stochastic optimization and algorithms, with applications to communications and network science. He is a fellow of the IEEE, AMS, TWAS, and the science and engineering academies in India.

3. **Jorge Cortés** received the Licenciatura degree in mathematics from the Universidad de Zaragoza, Zaragoza, Spain, in 1997, and the PhD degree in engineering mathematics from the Universidad Carlos III de Madrid, Madrid, Spain, in 2001. He joined the Department of Mechanical and Aerospace Engineering at UCSD in 2007. He was a postdoctoral research associate at the Systems, Signals, and Control Department, University of Twente, Enschede, The Netherlands (from January to June 2002), and at the Coordinated Science Laboratory, University of Illinois at Urbana-Champaign (from August 2002 to September 2004). From 2004 to 2007, he was an assistant professor with the Department of Applied Mathematics and Statistics at the University of California, Santa Cruz. He received the National Science Foundation (NSF) CAREER Award in 2006 and received the 2006 Spanish Society of Applied Mathematics Young Researcher Prize. He is the author of the book *Geometric, Control and Numerical Aspects of Nonholonomic Systems* (New York: Springer-Verlag, 2002) and a coauthor of the book *Distributed Control of Robotic Networks* (Princeton: Princeton University Press, 2009). He has coauthored papers that have received the 2008 IEEE Control Systems Outstanding Paper Award, the 2009 SIAM Review SIGEST selection from the *SIAM Journal on Control and Optimization*, and the 2012 O. Hugo Schuck Best Paper Award in the Theory category. He is an IEEE Control Systems Society Distinguished Lecturer. He has served on the Editorial Boards of the *European Journal of Control*, *IEEE Transactions on Automatic Control*, and *Systems and Control Letters*. He currently serves on the Editorial Boards of *IEEE Control Systems Magazine*, *SIAM Journal on Control and Optimization*, and *Journal of Geometric Mechanics*.
4. **Constantine Caramanis** received the PhD degree in EECS from MIT. He has been on the faculty in the Electrical and Computer Engineering Department at the University of Texas Austin since 2006. His current research interests focus on decision-making in large-scale complex systems, with a focus on learning and computation. Specifically, he is interested in robust and adaptable optimization, high-dimensional statistics and machine learning, and applications to large-scale networks, including social networks, wireless networks, transportation networks, and energy networks. He received the US National Science Foundation (NSF) CAREER Award in 2011.
5. **Cheng-Shang Chang** received the BS degree from the National Taiwan University, Taipei, Taiwan, in 1983, and the MS and PhD degrees from Columbia University, New York, NY, in 1986 and 1989, respectively, all in electrical engineering. From 1989 to 1993, he was employed as a research staff member at the IBM Thomas J. Watson Research Center, Yorktown Heights, N.Y. Since 1993, he has been with the Department of Electrical Engineering at National Tsing Hua University, Taiwan, R.O.C., where he is a Tsing Hua chair professor. His current research interests are concerned with network science, high-speed switching, communication network theory, and mathematical modeling of the Internet. He received an IBM Outstanding Innovation Award in 1992, an IBM Faculty Partnership Award in 2001, and Outstanding Research Awards from the National Science Council, Taiwan, in 1998, 2000 and 2002, respectively. He is the author of the book *Performance Guarantees in Communication Networks* and the coauthor of the book *Principles, Architectures and Mathematical Theory of High Performance Packet Switches*. He served as an editor for *Operations Research* from 1992 to 1999 and an editor for *IEEE/ACM Transactions on Networking* from 2007 to 2009. He is currently serving as an editor-at-large for *IEEE/ACM Transactions on Networking*. He is a member of IFIP Working Group 7.3.
6. **Moez Draef** graduated from the Ecole Polytechnique, Paris, in 2000. He then completed a DEA in probability theory at the University Paris VI. He undertook the PhD degree in the LIAFA (Theoretical Computer Science Group), University Paris VII. From October 2004 to January 2007, he was a Marie Curie research fellow at the Statistical Laboratory and a lecturer in Part III (Certificate of Advanced Study in Mathematics), Cambridge University. His main research interests are the analysis of distributed algorithms, and network economics and dynamics. It involves the mathematical analysis of models of large networks that arise in online systems using tools from probability theory.
7. **Fan Chung Graham** is a distinguished professor of mathematics and professor of computer science and engineering at the University of California, San Diego. She is also the Paul Erdos professor in combinatorics. Her research interests are primarily in graph theory, combinatorics, and algorithmic analysis. She specializes in spectral graph theory, external graphs, the theory of quasi-randomness and the probabilistic analysis of complex networks. Recently, her work includes local graph algorithms for complex networks and random walks based ranking algorithms. She received the Allendoerfer Award by Mathematical Association of America in 1990. She is a member of the American Academy of Arts and Sciences and a fellow of American Mathematical Society.
8. **Domitilla Del Vecchio** received the PhD degree in control and dynamical systems from Caltech, Pasadena, and the Laurea degree in electrical engineering from the University of Rome at Tor Vergata in 2005 and 1999, respectively. From 2006 to 2010, she was an assistant professor in the Department of Electrical Engineering and Computer Science and in the Center for Computational Medicine and Bioinformatics at the University of Michigan, Ann Arbor. In 2010, she joined the Department of Mechanical Engineering and the Laboratory for Information and Decision Systems (LIDS) at the Massachusetts Institute of Technology (MIT), where she is currently the W. M. Keck Career Development associate professor in biomedical engineering. She received the Donald P. Eckman Award from the American Automatic Control Council (2010), the National science Foundation (NSF) Career Award (2007), the Crosby Award, University of Michigan (2007), the American Control Conference Best Student Paper Award (2004), and the Bank of Italy Fellowship (2000).

9. **John C Doyle** received the BS, MS degrees EE, MIT in 1977, and the PhD degree in Math from UC Berkeley in 1984. He is the Jean-Lou Chameau professor of control and dynamical systems, electrical engineering, and bioengineering at Caltech. His current interests are in theoretical foundations for complex networks in engineering and biology, unifying controls, computing, communications, and physics. Emphasis on architecture, dynamics, feedback, layering, tradeoffs, evolvability. Case studies drawn from throughout technology plus cell biology, physiology, ecology, multiscale physics, neuroscience, and fashion. Early work was in the mathematics of robust control, including extensions to nonlinear and networked systems, with applications in aerospace and process control. Paper prizes include IEEE Baker (top paper in all IEEE publications), *IEEE Automatic Control Transactions* (twice), and best conference papers in ACM Sigcomm and AACC American Control Conference. Individual awards include AACC Eckman and IEEE Control Systems Field and Centennial Outstanding Young Engineer Awards.
10. **Raissa D'Souza** received the PhD degree in statistical physics from MIT in 1999. She was a postdoctoral fellow, first in fundamental mathematics and theoretical physics at Bell Laboratories, and then in the Theory Group at Microsoft Research. She is a professor of computer science and of mechanical engineering at the University of California, Davis, as well as an external professor at the Santa Fe Institute. Her research focuses on mathematical models of self-organization, phase transitions, and the structure and function of networked systems. Her interdisciplinary work on network theory spans the fields of statistical physics, theoretical computer science and applied mathematics. She has been selected as a Kavli fellow of the National Academy of Sciences four times and is a member of the Science Steering Committee of the Santa Fe Institute. She has served on the program committees for numerous conferences, currently serves on the editorial boards of several international mathematics and physics journals, and is a member of the World Economic Forum's Global Agenda Council on Complex Systems.
11. **Massimo Franceschetti** received the Laurea degree, magna cum laude, in computer engineering from the University of Naples in 1997, and the MS and PhD degrees in electrical engineering from the California Institute of Technology in 1999, and 2003. He is an associate professor in the Department of Electrical and Computer Engineering of University of California at San Diego. Before joining UCSD, he was a postdoctoral scholar at U.C. Berkeley, for two years. He received the C.H. Wilts Prize in 2003 for best doctoral thesis in Electrical Engineering at Caltech; the S.A. Schelkunoff award in 2005 for best paper in the *IEEE Transactions on Antennas and Propagation*; an NSF CAREER award in 2006, an ONR Young Investigator award in 2007; and the IEEE Communications Society best tutorial paper award in 2010.
12. **Zachary Ives** is a professor and the Markowitz faculty fellow at the University of Pennsylvania. His research interests include data integration and sharing, "big data," sensor networks, information networks, and data provenance and authoritativeness. He received the US National Science Foundation (NSF) CAREER award, and an alumnus of the US Defense Advanced Research Projects Agency (DARPA) Computer Science Study Panel and Information Science and Technology advisory panel. He has also been awarded the Christian R. and Mary F. Lindback Foundation Award for Distinguished Teaching. He serves as the undergraduate curriculum chair for Penn's Singh Program in Networked and Social Systems Engineering. He is a coauthor of the textbook *Principles of Data Integration*, and received an ICDE 2013 ten-year Most Influential Paper Award.
13. **Rahul Jain** received the PhD degree in EECS, and the MA degree in statistics, both from the University of California, Berkeley. He also received the MS degree in ECE from Rice University, where he received the Texas Instruments Fellowship. He is an associate professor and the Kenneth C. Dahlberg Early Career chair in the Electrical Engineering Department at the University of Southern California, Los Angeles. Prior to joining USC, he was a postdoctoral member of the research staff at the Mathematical Sciences Division of the IBM T.J. Watson Research Center, Yorktown Heights, NY. He has received numerous awards, including a James H. Zumberge Faculty Research and Innovation Award in 2009, an IBM Faculty Award, the US National Science Foundation (NSF) CAREER Award in 2010 and the ONR Young Investigator Award in 2012. He is a contributing member of many professional societies including ACM, IEEE Communications, Control Systems and Information Theory Societies, and Institute for Operations Research and Management Science (INFORMS). He has diverse research interests with current focus on Game Theory and Economics for Networks, and Stochastic Control and Learning. He was the lead guest editor of a special issue in the *IEEE Journal on Selected Areas in Communications*, served as the TPC co-chair of GameNets 2011, as a TPC member of IEEE INFOCOM 2011, 2012, and has earlier served on the TPCs of IEEE INFOCOM-WiP Conference, IEEE PIMRC Conference, IEEE SECON Conference, Game-Comm Workshop, ACM CoRoNet Conference, IEEE Bandwidth on Demand (BoD) Workshops. He is one of the co-organizers of the Annual Southern California Network Economics and Game Theory Symposium since 2009.
14. **Tara Javidi** received the BSE degree in 1996 from the Sharif University of Technology in Tehran, Iran, and the MS degree in electrical engineering and computer science from the University of Michigan in 1998. She received the MS degree in applied mathematics in 1999, and the PhD degree in EECS in 2002, both from the University of Michigan. She joined the University of Washington as an assistant professor in 2002, and received the US National Science Foundation (NSF) Career Award in 2004. Her research area involves stochastic analysis, design, and control of information collection, processing, and transfer in modern communication and networked systems.
15. **Eric Kolaczyk** is a professor of statistics and the director of the program in statistics, in the Department of Mathematics and Statistics at Boston University, where he also is an affiliated faculty member in the Program in Bioinformatics, the Program in Computational Neuroscience, and the Division of Systems Engineering. His main research

interests currently revolve around the statistical analysis of network-indexed data, and include both the development of basic methodology and inter-disciplinary work with collaborators in bioinformatics, computer science, geography, neuroscience, and sociology. Besides various research articles on these topics, he has also authored a book in this area—*Statistical Analysis of Network Data: Methods and Models* (Springer, 2009). He has given various short courses on material from his book in recent years, including for the Center for Disease Control (CDC) and the Statistical and Applied Mathematical Sciences Institute (SAMSI) in the US as well as similar venues in Belgium, England, and France. Prior to his working in the area of networks, He spent a decade working on statistical multi-scale modeling. He has served as associate editor on several journals, including currently the *Journal of the American Statistical Association* and previously the *IEEE Transactions in Image Processing*. He has also served as a co-organizer for workshops focused on networks and network data. He is an elected fellow of the American Statistical Association (ASA), an elected senior member of the IEEE, and an elected member of the International Statistical Institute (ISI).

16. **Marc Lelarge** graduated from École Polytechnique, Palaiseau, France, qualified as an engineer at École Nationale Supérieure des Télécommunications, Paris, and the PhD degree in applied mathematics from École Polytechnique in 2005. He is a researcher at INRIA in the DYOGENE research team, which is a part of the Computer Science Department of École Normale Supérieure, Paris, France. His research interests include discrete probability and combinatorial optimization, network algorithms, network economics and statistical inference. He was ACM SIGMETRICS 2014 TPC co-chair and has served on the program committees of ACM SIGMETRICS, WiOpt, NetCoop, GameSec. He serves on the editorial boards of *Queueing Systems* and the *Bernoulli Journal*. He received the NetGCoop 2011 Best Paper Award with E. Coupechoux and received the 2012 SIGMETRICS Rising Star Researcher Award.
17. **Jure Leskovec** received the bachelor's degree in computer science from the University of Ljubljana, Slovenia, and the PhD degree in machine learning from Carnegie Mellon University and postdoctoral training at Cornell University. He is an assistant professor of computer science at Stanford University, where he is a member of the Info Lab and the AI Lab. His research focuses on mining large social and information networks. Problems he investigates are motivated by large scale data, the web and on-line media. His research has won several awards, including best paper awards at KDD (2005, 2007, 2010), WSDM (2011), ICDM (2011) and *ASCE Journal of Water Resources Planning and Management* (2009), ACM KDD dissertation award (2009), Microsoft Research Faculty Fellowship (2011), as well as Alfred P. Sloan Fellowship (2012).
18. **Mehran Mesbahi** received the PhD degree from USC in 1996. He was a member of the Guidance, Navigation, and Analysis Group at the Jet Propulsion Laboratory from 1996-2000 and an assistant professor of aerospace engineering and mechanics at the University of Minnesota from 2000 to 2002. He is currently a professor of aeronautics and astronautics, adjunct professor of mathematics, and executive director of the Joint Center for Aerospace Technology Innovation at the University of Washington in Seattle. He has co-authored the book *Graph Theoretic Methods in Multi-agent Networks* (Princeton 2010) and is an associate editor for the *IEEE Transactions on Control of Network Systems*. He received the US National Science Foundation (NSF) CAREER Award in 2001, NASA Space Act Award in 2004, UW Distinguished Teaching Award in 2005, and UW College of Engineering Innovator Award in 2008. His research interests include distributed and networked systems, systems and control theory, and engineering applications of optimization and combinatorics.
19. **Andrea Montanari** received the Laurea degree in physics in 1997, and the PhD degree in theoretical physics in 2001 (both from Scuola Normale Superiore in Pisa, Italy). He has been a postdoctoral fellow at Laboratoire de Physique Théorique de l'École Normale Supérieure (LPTENS), Paris, France, and the Mathematical Sciences Research Institute, Berkeley. Since 2002, he has been a Chargé de Recherche (with Centre National de la Recherche Scientifique, CNRS) at LPTENS. In September 2006, he joined Stanford University as a faculty member; and since 2010, he has been an associate professor in the Departments of Electrical Engineering and Statistics. He co-received the ACM SIGMETRICS Best Paper Award in 2008. He received the CNRS bronze medal for theoretical physics in 2006, the National Science Foundation CAREER award in 2008, and the Okawa Foundation Research Grant in 2013.
20. **Elchanann Mossel** studies mathematical, probabilistic, statistical and algorithmic problems arising in the theory of computing, in molecular biology and evolution, network economics and social choice. He received the PhD degree from the Hebrew University, conducted postdoctoral studies in the theory group of Microsoft's research division, and was a Miller fellow at U.C. Berkeley. He is currently a professor in the Departments of Statistics and Computer Science at U.C. Berkeley and a member of the faculty of Mathematics and Computer Science at the Weizmann Institute. He has received a number of prestigious grants and awards, including an Alfred Sloan Fellowship in Mathematics, and a National Science Foundation Career Award.
21. **Eric Moulines** received the engineering degree from Ecole Polytechnique, Paris, France, in 1984, the PhD degree in electrical engineering from Ecole Nationale Supérieure des Télécommunications in 1990. In 1990, he joined the Signal and Image processing department at Télécom ParisTech, where he became a full professor in 1996. His areas of expertise include statistical signal processing (detection, estimation), computational statistics, machine learning and time series analysis. His current research topics cover sparsity in signal and systems, large-scale inference, inverse problems, and applications of machine learning to telecommunication problems (cognitive radio, self-organizing networks). He has published more than 100 papers in leading journals of the field. In 1997 and 2006, he received the Best paper Award of the IEEE Signal Processing Society (for papers in the *IEEE Transactions on Signal Processing*). He is currently Editor in Chief of *Bernoulli*. He served on the editorial boards of *IEEE Transactions on Signal*

Processing, Signal Processing, Stochastic Processes and Applications, Journal of Statistical Planning and Inference. He is a EURASIP fellow. He received the 2010 Silver Medal from the Centre National de Recherche Scientifique and the 2011 Orange prize of the French Academy of Sciences.

22. **Mason A. Porter** received the PhD degree in 2002 from Cornell University. He is a professor of nonlinear and complex systems in the Mathematical Institute, based primarily in the Oxford Centre for Industrial and applied mathematics (and with courtesy affiliations in the mathematical biology and discrete mathematics groups). He is also a Tutorial fellow of Somerville College. His research encompasses complex and nonlinear systems, and he focuses in particular on networks, dynamics of networks, and dynamics on networks. His work ranges from modeling (e.g., of social influence on networks) to development of new methodologies and data analytics (e.g., for community structure and other meso-scale network structures). He is also helping to pioneer the development of tools and applications for the investigation of multilayer networks. He has acted as supervisor for three postdoctoral scholars, 15 doctoral students, more than 25 masters students, and more than 60 undergraduate research projects. He has published more than 100 papers, given invited talks at universities and conferences throughout the world, and received large grants from the James S. McDonnell Foundation, EPSRC, and the European Commission. He won the Sigma Xi Young Investigator Award in 2008.
23. **Fabio Pammolli** graduated in economics from the University of Pisa and the doctoral studies in economics and management at the Sant'Anna School of Advanced Studies. He is a professor of economics and management at IMT, in Lucca, Italy, where he has coordinated the PhD degree in economics and he serves as the director of the research unit *Axes* (Analysis of complex Economic Systems). He served (2004-2012) as the founding director and the president of the executive council of IMT Institute for Advanced Studies (www.imtlucca.it). As the founding director of the Institute, he presided over its establishment as an international research university. Unique within the Italian system, IMT represents a remarkable innovation in terms of organization of research, and selection and hiring procedures for faculty and students. He is the president of the CERM Foundation an independent research institute specialized in analyzing the sustainability of public finances and the economics of pensions and health. From 1991 to 2001, he was at the University of Siena; while from 2001 to 2004, he was a professor of economics and management at the University of Florence. He has visited several institutions, including Northeastern University, MIT, and Stanford University. He combines different methodologies to cover a variety of topics in economics of science and innovation, industrial economics, the economics of health and pensions, and network analysis of large socio-economic systems. He is a leading expert in the economic analysis of biotechnology and pharmaceuticals and has published extensively in major Economics journals, in Management Science, as well as in *Science*, *Nature*, and *PNAS*. He is currently writing a book on growth and instability in economic systems.
24. **Sandip Roy** received the BS degree from the University of Illinois at Urbana Champaign in 1998, and the MS and PhD degrees from the Massachusetts Institute of Technology in 2000 and 2003, respectively, all in electrical engineering. Since 2003, he has been a faculty member at Washington State University, currently serving as an associate professor in the School of Electrical Engineering and Computer Science and as an affiliate faculty member in the School of Global Animal Health. His research is focused on developing methods for inference and control of dynamical networks, and using these methods to inform decision support for large-scale infrastructure networks like air transportation networks and agricultural systems. This research effort has been supported by mixture of public and corporate sponsors, and has resulted in more than 60 publications in multidisciplinary journals, software prototypes used by sponsors, conference-proceedings publications, technical reports, and other products.
25. **Amin Saberi** received the BSc degree from Sharif University of Technology and the PhD degree from Georgia Institute of Technology in Computer Science. He is an associate professor and 3COM faculty scholar in Stanford University. His research interests include algorithms, approximation algorithms, and algorithmic aspects of games, markets, and networks. His research is supported by the National Science Foundation (under grants CCF 0546889, 0729586, and 0915145), Library of Congress, Stanford Clean Slate Design for the Internet, and Google. His most recent awards include an Alfred Sloan Fellowship and Best Paper Awards in FOCS 2011 and SODA 2010.
26. **Rodolphe Sepulchre** received the engineering degree and the PhD degree in applied mathematics from the University of Louvain, Belgium, in 1990 and 1994, respectively. He is a professor of information engineering at the University of Cambridge. Previously, he was a professor and the chair at the Department of Electrical Engineering and Computer Science at the University of Liege, Belgium. He held various research and visiting positions at UCSB (1994-1996), Princeton (2002-2003), and Mines Paris-Tech (2009-2010). His main research interests include nonlinear control systems, optimization on matrix manifolds with applications to large-scale problems in linear algebra, and applications of dynamical systems, in particular in the area of rhythmic and collective behavior. He currently serves as an associate editor for the journals *SIAM J. of Control and Optimization*, *Mathematics of Control, Signals, and Systems*, *Journal of Nonlinear Science*, and *Systems and Control Letters*. He is a fellow of the IEEE and received the 2008 IEEE CSS Ruberti young researcher prize.
27. **Devavrat Shah** received the bachelor's of technology in computer science and engineering from the Indian Institute of Technology, Bombay, in 1999 with the Presidents of India Gold Medal—awarded to the best graduating student across all engineering disciplines. He received the PhD degree in computer science from Stanford University in 2004. He is currently a Jamieson career development associate professor with the Department of Electrical Engineering and Computer Science, MIT. He is a member of the Laboratory for Information and Decision Systems (LIDS) and Operations Research Center (ORC). His research focus is on theory of large complex networks which includes

network algorithms, stochastic networks, network information theory and large scale statistical inference. His doctoral thesis titled "Randomization and Heavy Traffic Theory: New Approaches for Switch Scheduling Algorithms" was completed under supervision of Balaji Prabhakar. His thesis was adjudged winner of the George B. Dantzig best dissertation award from INFORMS in 2005. After spending a year between Stanford, Berkeley and MSRI, he started teaching at MIT in Fall 2005. He has been co-awarded Best Paper Awards at the IEEE INFOCOM '04, ACM SIGMETRICS/Performance '06; and he has supervised best student paper awards at Neural Information Processing Systems '08, ACM SIGMETRICS/Performance '09 and Management Science and Operations Management Paper competition '10. He was awarded the first ACM SIGMETRICS Rising Star Award 2008 for his work on network scheduling algorithms. He received the 2010 Erlang Prize from INFORMS which is given to a young researcher for outstanding contributions to applied probability. He is currently an associate editor of *Operations Research*.

28. **Amit Singer** received the BS degree in physics and mathematics and the PhD degree in applied mathematics from Tel Aviv University, Israel, in 1997 and 2005, respectively. He is a professor of mathematics and a member of the Executive Committee of the Program in Applied and Computational Mathematics (PACM) at Princeton University. He joined Princeton as an assistant professor in 2008 and was promoted to a full professor in 2013. From 2005 to 2008, he was a Gibbs assistant professor in applied mathematics at the Department of Mathematics, Yale University. He served in the Israeli Defense Forces during 1997-2003. He received the Alfred P. Sloan Research Fellowship (2010), the Presidential Early Career Award for Scientists and Engineers (2010) and the Haim Nessyahu Prize for Best PhD in Mathematics in Israel (2007), and was selected as a Simons Foundation Investigator in 2012. His current research in applied mathematics focuses on problems of networks, massive data analysis, and structural biology.
29. **Leandros Tassioulas** received the PhD degree in electrical engineering from the University of Maryland, College Park, 1991. He is the John C. Malone professor of electrical engineering at Yale. His research interests are in the field of computer and communication networks with emphasis on fundamental mathematical models and algorithms of complex networks, architectures and protocols of wireless systems, sensor networks, novel Internet architectures and experimental platforms for network research. His most notable contributions include the max-weight scheduling algorithm and the back-pressure network control policy, the maximum lifetime approach for wireless network energy management, and the consideration of joint access control and antenna transmission management in multiple antenna wireless systems. He is a fellow of the IEEE in 2007, while his research has been recognized by several awards including the inaugural INFOCOM 2007 Achievement Award "for fundamental contributions to resource allocation in communication networks," the INFOCOM 1994 best paper award, a National Science Foundation (NSF) Research Initiation Award (1992), an NSF CAREER Award (1995), an Office of Naval Research Young Investigator Award (1997) and a Bodossaki Foundation award (1999). He has held faculty positions at Polytechnic University, New York, University of Maryland, College Park, and University of Thessaly, Greece.
30. **Adam Wierman** received the BSc, MSc, and PhD degrees in computer science from Carnegie Mellon University in 2007, 2004, and 2001, respectively. He is a professor in the Department of Computing and Mathematical Sciences at the California Institute of Technology, where he is a founding member of the Rigorous Systems Research Group (RSRG) and maintains a popular blog called Rigor + Relevance. His research interests center around resource allocation and scheduling decisions in computer systems and services. More specifically, his work focuses both on developing analytic techniques in stochastic modeling, queueing theory, scheduling theory, and game theory, and applying these techniques to application domains such as energy-efficient computing, data centers, social networks, and electricity markets. He received the 2011 ACM SIGMETRICS Rising Star award, and has been coauthor on papers that received best paper awards at ACM SIGMETRICS, IEEE INFOCOM, IFIP Performance, IEEE Green Computing Conference, IEEE Power & Energy Society General Meeting, and ACM GREENMETRICS. He was named a Seibel Scholar, received the Okawa Foundation Grant, and received the National Science foundation (NSF) CAREER grant. Additionally, his dissertation received the CMU School of Computer Science Distinguished Dissertation Award, his work with HP was named a Computerworld Honors Laureate, and he has received multiple teaching awards. He has served on the board of directors of ACM Sigmetrics and on the editorial boards of *Performance Evaluation*, *Operations Research*, *Queueing Systems*, and the *IEEE Transactions on Cloud Computing*.
31. **Walter Willinger** studied Mathematics at the ETH Zurich, Switzerland, and received the MS and PhD degrees from the School of ORIE, Cornell University, Ithaca, NY. He is currently the chief scientist at Niksun. For the last 15 years, he was at AT&T Labs-Research, the research arm of AT&T. Before that, he was a Member of Technical Staff at Bellcore Applied Research (1986-1996), the research consortium that was jointly own by the 7 Baby Bells. His work on the self-similar ("fractal") nature of Internet traffic, he received the 1996 IEEE W.R.G. Baker Prize Award from the IEEE Board of Directors, the 1994 W.R. Bennett Prize Paper Award from the IEEE Communications Society, and the 2006 "Test of Time" Paper Award from ACM SIGCOMM. He is a fellow of the ACM (2005), IEEE (2005), AT&T (2007), and SIAM (2009).
32. **Edmund Yeh** received the BS degree in electrical engineering with distinction from Stanford University in 1994, the MPhil degree in engineering from the University of Cambridge in 1995, and the PhD degree in electrical engineering and computer science from MIT under professor Robert Gallager in 2001. Since July 2011, he has been an associate professor of electrical and computer engineering at Northeastern University. Previously, he was an assistant and an associate professor of electrical engineering, computer science, and statistics at Yale University. He has held visiting positions at MIT, Princeton, University of California at Berkeley, Swiss Federal Institute of Technology Lausanne (EPFL), and Technical University of Munich. He received the Alexander von Humboldt Research Fellowship, the

Army Research Office Young Investigator Award, the Winston Churchill Scholarship, the National Science Foundation and Office of Naval Research Graduate Fellowships, the Barry M. Goldwater Scholarship, the Frederick Emmons Terman Engineering Scholastic Award, and the President's Award for Academic Excellence (Stanford University). He received the Best Paper Award at the IEEE International Conference on Ubiquitous and Future Networks (ICUFN), Phuket, Thailand, July 2012. He serves as the Secretary of the Board of Governors of the IEEE Information Theory Society. He is a senior member of the IEEE, a member of Phi Beta Kappa and Tau Beta Pi.

Scanning the Issue

Decoding Binary Node Labels from Censored Edge Measurements: Phase Transition and Efficient Recovery by Emmanuel Abbe, Afonso S. Bandeira, Annina Bracher, and Amit Singer

This paper addresses a very important and common inverse problem on graphs: Given noisy linear observation of Boolean variables on edges of a graph, recover the unknown vector of vertex variables. This model is motivated by coding, synchronization, and community detection problems. In particular, it corresponds to a stochastic block model or a correlation clustering problem with two communities and censored edges. Without noise, exact recovery (up to global flip) of the unknown vertex-sized variable is possible if and only the graph is connected, with a sharp threshold at the edge probability $\log(n)/n$ for Erdos-Renyi random graphs. The authors identify the information theoretic phase transition for exact recovery in terms of the edge density of the graph and the noise level, and devise an efficient algorithm based on semidefinite programming (SDP), which approaches the threshold up to a factor of 2 in the Erdos-Renyi case.

Distributed Online Convex Optimization over Jointly Connected Digraphs by David Mateos-Nuñez and Jorge Cortés

This paper considers networked, online convex optimization scenarios from a regret analysis perspective. At each round, each agent in the network commits to a decision and incurs a local cost given by functions that are revealed over time and the evolution model of local costs might be adversarially adaptive to the agent's behavior. The goal of each agent is to incur a cumulative cost over time with respect to the sum of local functions across the network that is competitive with the best single centralized decision in hindsight. To achieve this, agents cooperate with each other using local averaging over time varying weight-balanced digraphs as well as subgradient descent on the local cost functions revealed in the previous round. The authors propose a class of coordination algorithms that generalize distributed online subgradient descent and saddle-point dynamics, allowing proportional-integral (and higher-order) feedback on the disagreement among neighboring agents. We show that our algorithm design achieves logarithmic agent regret (when local objectives are strongly convex), or square-root agent regret (when local objectives are convex) in scenarios where the communication graphs are jointly connected. Simulations in a medical diagnosis application illustrate the results.

A Brief Survey of PageRank Algorithms by Fan Chung

In this paper, the author presents a brief survey of computational methods for approximate computation of the PageRank vector. In 1998, Brin and Page introduced the notion of PageRank for ranking websites as part of Google's web search. Different from the usual methods in pattern matching previously used in data retrieval, the novelty of PageRank relies entirely on the underlying web graph to determine the "importance" of a Webpage. Given that the Page Rank vector needs to be computed for very large graphs, the paper surveys some recent results on approximation algorithms for fast, scalable computation. The paper then briefly discusses some recent generalizations.

All-to-All Communication in Random Regular Directed Graphs by Joohwan Kim, Arash Ghayoori, and R. Srikant

In this paper, the authors consider networks formed by the union of M random 1-regular directed graphs. These graphs are also called permutation models in the literature. The authors first show that the expansion factor of such graphs is greater than or equal to $\log N$, asymptotically almost surely when $M > 4 \log N$, where N is the number of nodes in the network. Next, the authors present applications of such random graph models in the design of peer-to-peer networks and data center networks of switches. Assuming that each node in the network has upload and download capacities greater than $8 \log N$; they also show that the above result implies that all-to-all communication is possible in such a network, if the total incoming data rate and the total outgoing data rate at each node are both less than or equal to 1.

Robust Network Routing under Cascading Failures by Ketan Savla, Giacomo Como, and Munther A. Dahleh

In this paper, the authors propose a dynamical model for cascading failures in network flows problems, where the network state consists of flows and activation status of the links. Network dynamics is determined by a disturbance process that reduces flow capacity on links, and routing policies at the nodes that have access to the network state, but are oblivious to the presence of the disturbance. Under the proposed dynamics, a link becomes irreversibly inactive either due to overload condition on itself or on all of the immediate downstream links. The coupling between link activation and flow dynamics implies that links to become inactive successively are not necessarily adjacent to each other. The magnitude of a disturbance process is defined as the cumulative capacity reduction across time and links of the network, and the margin of resilience of the network as the infimum over the magnitude of all disturbance processes under which the links at the origin node become inactive. The authors present an algorithm to compute an upper bound on the margin of resilience when the routing policy only has access to the local state of the network. They also identify sufficient conditions on network parameters under which the upper bound is tight under an appropriate routing policy.