Plenary sessions

Professor Saif Benjaafar

University of Minnesota, USA

TITLE: Carbon Footprint and the Management of Supply Chains: Insights from Simple Models

Using relatively simple and widely used models, we illustrate how carbon emission concerns could be integrated into operational decision-making with regard to procurement, production, and inventory management. We show how, by associating carbon footprint parameters with various decision variables, traditional models can be modified to support decision-making that accounts for both cost and carbon footprint. We examine how the values of these parameters as well as the parameters of regulatory emission control policies, such as a tax on carbon emissions or a cap-and-trade system, affect cost and emissions. We use the models to study the extent to which carbon reduction requirements can be addressed by operational adjustments alone, as an alternative to costly investments in carbon-reducing technologies. We also use the models to investigate the impact of collaboration among firms within the same supply chain on their costs and carbon emissions and study the incentives firms might have in seeking such cooperation. We provide a series of insights that highlight the impact of operational decisions on carbon emissions and the importance of operational models in evaluating the impact of different regulatory policies and in assessing the benefits of investments in more carbon efficient technologies.
(Joint work with Yanzhi Li, City University of Hong Kong and Mark Daskin, University of Michigan)

Saif Benjaafar is a Professor of Industrial & Systems Engineering at the University of Minnesota where he is also Director of the Industrial & Systems Engineering Program, Director of the Center for Supply Chain Research, and a Faculty Scholar with the Center for Transportation Studies. He was a Distinguished Senior Visiting Scientist at Honeywell Laboratories and a Visiting Professor at universities in France, Belgium, Hong Kong, China and Singapore. He Holds PhD and MS degrees from Purdue University and a BS degree from the University of Texas at Austin. His research is in the areas of supply chain management, service and manufacturing operations, and production and inventory systems, with a current focus on sustainability and environmental modeling. He is on the editorial board of several journals including *MSOM*, *POM*, *NRL*, and *IIE*. His papers have been published in various journals including *Management Science*, *Operations Research*, and *MSOM*. His research has been funded by several US government agencies, including NSF, DOT, DHS, and DARPA. He has consulted widely with leading companies such as Honeywell, General Mills, 3M, and Intel among many others. He is a Fellow of the Institute of Industrial Engineers (IIE). More information can be found on his website:

http://www.ie.umn.edu/faculty/faculty/Benjaafar.shtml.

Jean Baptiste Léger
President of the PREDICT company

TITLE: KASEM©: a collaborative e-Maintenance platform, integrating engineering, proactive maintenance, decision making and expertise tools.

PREDICT develops software applications of monitoring, diagnosis and prognosis in order to bring an Intelligent Maintenance System at the Manufacturing Execution System level connected to the Enterprise Resources Planning level. The principle of these applications is to carry out in time-reality an anticipated diagnosis and a prognosis of the deviation, in order to propose corrective and preventive actions in real-time.

KASEM©, based on a collaborative web platform, integrates both engineering tools and proactive maintenance tools in order to optimise maintenance through feedback and return of experience by the implementation of an Expertise Centre (diagnostic, investigation, prognostic, expertise, optimisation...).

The KASEM© framework provides enterprises level application services and business process coordination. The advancement and widespread adoption of web technologies validates the fact that enterprises need the flexibility and agility of multiple key systems that will run their enterprise the most efficiently and an infrastructure to easily deploy and tie these systems together. KASEM© platform is a high heterogeneous and distributed system.

Engineering modules integrate different maintenance engineering methods: HAZOP (HAZard and OPerability study), FMECA (Failure Modes, Effects and Criticality Analysis) and FTA (Fault Tree Analysis).

Dr. Jean-Baptiste Léger is President of the PREDICT company, PREDICT is specialized in the field of Intelligent Maintenance System. His PhD thesis presented in 1999 was on Formal Modelling Framework of Proactive Systems. He is working on formal approach of Fault Tolerant Systems. He participates to the CNRS (French Research Council) MACOD working group. He is member of the IFAC TC 5.1 on Manufacturing Plant Control and A-MEST Working Group. He has acted in internatinal conference program committees. He was invited for PhD thesis evaluation at the Institut National Polytechnique de Grenoble, the Nancy University and the Metz University. He gave invited talks during summer schools. He published 4 papers in reviews and book since 1999 and more than 30 papers in conferences and workshops since 2000.

Professor Dave Goldsman,
Georgia Institute of Technology, USA

TITLE: The State-of-the-Art in Simulation Output Analysis.

Computer simulation is perhaps the most widely used methodological tool in the field of Operations Research and Industrial Engineering; it is used for modeling, evaluating, and optimizing complicated systems that are too difficult to "solve" via traditional analytical means. A fundamental problem in simulation analysis concerns the computation of point and confidence interval (CI) estimators for the steady-state mean of a simulation-generated output process. If the simulation is in steady-state operation, then the sample mean of the associated time series is an unbiased estimator of the steady-state mean response. However, since simulation outputs are usually autocorrelated, asymptotically valid CIs for the steady-state mean must be based not only on the sample mean but also on a sufficiently accurate estimator of the (asymptotic) variance parameter, which can be used to gauge the standard error of the sample mean. In this talk, we detail recent advances in variance parameter estimation and outline potential areas for further research activities.

Dave Goldsman is a Professor in the School of Industrial and Systems Engineering at the Georgia Tech. He received his Ph.D. in 1984 from Cornell University; and over the years, he has been a Visiting Professor at Cornell, North Carolina–Chapel Hill, Middle East Technical University, Northwestern, Oklahoma, Sabancı University, and Boğaziçi University.

Dave's research interests include simulation output analysis, statistical ranking and selection methods, and medical and humanitarian applications of operations research, and he has published extensively in those areas. He has also co-authored the texts Design and Analysis of Experiments for Statistical Selection, Screening and Multiple Comparisons, with Bob Bechhofer and Tom Santner, and Probability and Statistics in Engineering (4th edition), with Bill Hines, Doug Montgomery, and Connie Borror.

Dave is an Associate Editor for Sequential Analysis and the European Journal of Industrial Engineering. He was previously the Simulation Department Editor for IIE Transactions and an Associate Editor for Operations Research Letters. He was also the IIE Board Representative to the Winter Simulation Conference during 2001–2009 and has served on the INFORMS Public Awareness Committee for 15 years.

Dave and Christos Alexopoulos won the INFORMS Simulation Society's 2007 Outstanding Simulation Publication Award for their paper "To Batch Or Not To Batch?" which appeared in ACM TOMACS in 2004. In addition, Dave, Christos, Claudia Antonini, and Jim Wilson recently won the IIE Transactions 2010 Best Paper Prize in Operations Engineering and Analysis for their 2009 paper "Area Variance Estimators for Simulation Using Folded Standardized Time Series." Dave received the INFORMS Simulation Society's Distinguished Service Award in 2002, and a Fulbright fellowship in 2006 to lecture at Sabancı University, and Boğaziçi Universities in Istanbul, Turkey.

Professor Katta G. Murty
University of Michigan, Ann Arbor, USA
KFUPM (King Fahd University of Petroleum and Minerals), Dhahran, Saudi Arabia

TITLE: Optimizing the Gross Crane Rate (GCR) in a Container Terminal

From my experience on decision making applications, I noticed that the following are important for successful decision making (that's why I call them: Murty´s 3-commandments for successful decision making).

1. Looking at the problem from all possible angles and not just one way.
2. Constructing an intelligent mathematical model to analyze the problem and solve it.
3. Being very tactful in selling the optimum solution and in implementing it.

I will illustrate these with a case study on work done on improving the *GCR (Gross Crane Rate)* at container terminals in Hong Kong and Singapore ports.

A Container vessel arrives and docks at a berth inside the terminal bringing import containers (also called inbound containers) from other ports. The QC (Quay Cranes) of the terminal then unload the import containers in the vessel, and put each of them on a TIT (Terminal's Internal Truck) which line up by the side of the QC.

The TIT takes the import container to the SY (Storage Yard) inside the terminal for storage until its owner sends their ET (External Truck) to pick it up.

Exporters pack their goods in containers and send these export containers (also called outbound containers) on their ETs to the terminal. Each of these ETs take the export container on them to the SY for storage until the vessel into which they are to be loaded arrives and docks at a berth of the terminal. At that time, an RTGC (Rubber-Tyred Gantry Crane) in the storage block where the export container is stored, retrieves it from storage, puts it on a TIT which takes it to the docked vessel. The QC serving the vessel then loads the container in a hatch of the vessel.

There are two performance measures to determine the efficiency of a container terminal. One is the GCR, which is the average number of Lifts (unloading of an import container from, or loading of an export container into, the vessel) achieved at the terminal per QC-working hour. Ideally the GCR can be as high as 40, but most good terminals attain GCR values of 30 or higher. The 2nd performance measure in the Vessel Turnaround Time (the time taken by the terminal to process an arriving vessel, and send it off on its route) which should be minimized.

The daily operations at the terminal involve many decisions that affect the terminal's performance. Among them, the important one's are the policies used by the terminal to allocate storage spaces in the SY to arriving containers; the policies they use to allocate RTGCs to blocks in the SY; the policy they use for the arrival of ETs bringing export containers to the terminal etc.

We will discuss our work on developing optimal policies for some of these decision problems.

Katta G. Murty has been a faculty member in the IOE Department at the University of Michigan, Ann Arbor, for over 42 years, and currently he is also a Professor in the SE Department at KFUPM in Saudi Arabia. His area of specialization is optimization algorithms and their applications in a variety of industries, including container termials. He worked in a container terminal in Hong Kong Port to develop a DSS (Decision Support System) for the many decisions to be made in daily operations there, this work has been recognized with an Edelman Finalist Award of INFORMS, the national society for OR/MS in USA. Later, he worked along with one of his graduate students on similar decision problems in the container terminal at the Port of Singapore, and on optimizing the layout and design of the storage yard in container terminals.

His latest research project deals with developing practically efficient and fast descent methods for solving large scale linear programming models using matrix inversion operations sparingly or not at all. For this he is developing the new sphere methods for linear programs.