



Dr. Urmila Diwekar

Center for Uncertain Systems: Tools for
Optimization & Management
Vishwamitra Research Institute



Better Optimization of Nonlinear Uncertain Systems (BONUS) Algorithm for Large Scale Real World Stochastic Nonlinear Programming Problems

Abstract:

Stochastic programming problems are very difficult problems as they involve optimization as well as uncertainty analysis. Algorithms for solving large scale nonlinear stochastic programming problems are very few in number, as are the engineering applications of these problems. This talk is based on a recent book which introduces two recently developed algorithms for large scale stochastic nonlinear problems for both open equation systems and black box models. These algorithms are Better Optimization of Nonlinear Uncertain Systems (BONUS) and L-shaped BONUS. Illustrative examples of this algorithm includes quality control of a continuous stirred tank reactor for reducing variance in the yield, capacity expansion problem for electric utilities, farmer's problem in stochastic programming, and blending problem for petroleum industries. Real world applications of these algorithms in the areas of energy and environmental engineering are also detailed. The real world applications include sensor placement problem in Integrated Gasification Combined Cycle (IGCC) systems, real time water management in Pulverized Coal (PC) power plants, and water security networks for drinking water utilities.

Biography:

Dr. Urmila Diwekar is currently President of the Vishwamitra Research Institute (VRI, www.vri-custom.org), a non-profit research organization that she founded in 2004 to pursue multidisciplinary research in the areas of Optimization under Uncertainty and Computer aided Design applied to Energy, Environment, and Sustainability. From 2002-2004, she was a Professor in the Departments of Chemical Engineering, Bio Engineering, and Industrial Engineering, and in the Institute for Environmental Science and Policy, at the University of Illinois at Chicago (UIC). From 1991-2002 she was on the faculty of the Carnegie Mellon University, with early promotions to both the Associate and the Full Professor level.

In chemical engineering, she has worked extensively in the areas of simulation, design, optimization, control, stochastic modeling, and synthesis of chemical processes. She has made major contributions to research on batch distillation and this work is well recognized. Uncertainties are inherent in real world processes. Recognizing this, she started working in 1991 on stochastic modeling, efficient methods for uncertainty analysis, and optimization under uncertainty. These led to productive contributions in fields as diverse as advanced power systems, sustainability, environmental management, nuclear waste disposal, molecular modeling, pollution prevention, renewable energy systems, and biomedical engineering. The interdisciplinary

nature of the field developed into several research collaborations and in 1999 she founded the Center for Uncertain Systems: Tools for Optimization and Uncertainty (CUSTOM) to foster interactions between various industries, national laboratories and various academic disciplines. She is the author of more than 135 peer-reviewed research papers, and has given over 300 presentations and seminars, and has chaired numerous sessions in national and international meetings. She has been the principal advisor to 35 Ph.D. and M.S. students, and has advised several post-doctoral fellows and researchers. During the past 10 years, her students have won 6 best student paper awards from various AIChE and INFORMS sections at their respective meetings.

She wrote the first book on Batch Distillation in 1994, a second edition of the book is out in 2012. Her next book was Methods and Tools for Pollution prevention, which she co-edited with Dr. S. Sikdar, Associate Director for Science at the EPA NRMRL. Her third book was on the broader, discipline independent, field of Applied Optimization (the review of the first edition in OR/MS can be found on <http://www.vri-custom.org/pdfs/book3.pdf>). Springer published the second edition of her Applied Optimization book in 2008. More recently, along with Dr. H. Cabezas, Senior Science Advisor, Sustainable Technology Division, EPA NRMRL, she edited and contributed to Sustainability: a Multidisciplinary Perspective, which is published recently as an e-book from Bentham Science Publishers. She is currently completing her latest book, Design for Batch and Bio Processes, to be published next year by CRC Press. She has also written 12 book chapters.

Professionally, she is active in the AIChE, having served as a Member of the Executive Committee and as a Director in both the Computers and Systems Analysis division and in the Environmental division. She was also the first programming chair for AIChE's Sustainable Engineering Forum. Other than AIChE, she is also an active in INFORMS and AIMBE.

Besides academic research, she is the author of two commercial software packages (BdistSimOpt, Batch Process Technologies, W. Lafayette, IN, and MultiBatchDS, BPRC Inc., Allison Park, PA). She has also served as a consultant to more than 20 companies. From 1993-94, she worked at Simulation Sciences, CA.

During the past eighteen years, she has received grant support from the National Science Foundation, the Sandia National Laboratory, the National Renewable Energy Laboratory, the National Energy Technology Laboratory, the Argonne National Laboratory, the Electric Power Research Institute, the Environmental Protection Agency, the Pennsylvania Infrastructure Technology Alliance, Ford Motor Co., Mallinckrodt Chemicals, and BOC Gases. Overall, she has had 51 grants with approximately 11.2 million in funding.

In 2009, she was elected a Fellow of American Institute of Chemical Engineers (AIChE). In the same year, in recognition of her work on batch distillation research for pharmaceutical industries, her work on ecological sustainability, and biomedical engineering she was also elected a Fellow of the American Institute of Medical and Biological Engineering (AIMBE). In October 2011, she received the prestigious Cecil Award for Environmental Chemical Engineering from the Environmental Division of AIChE. She is the first woman to receive this national award in its 39-year history. In November 2011, she received the Thiele award for outstanding contributions to chemical engineering, awarded by the Chicago chapter of AIChE. This year, she has been nominated for the prestigious ENI Award from Europe.

Join Webinar Presentation at: <http://goo.gl/AqQPsm>

