

## Wei Xie

Rensselaer Polytechnic Institute  
110 8th Street, Center for Industrial Innovation, Room 5207  
Troy, NY 12180-3590  
Email: xiew3@rpi.edu  
Phone: 224-545-2578

### Position

Assistant Professor, Department of Industrial and Systems Engineering, Rensselaer Polytechnic Institute, Troy NY, USA.

### Education

NORTHWESTERN UNIVERSITY (NU), EVANSTON IL, USA

- Ph.D Industrial Engineering and Management Sciences June 2014
  - Dissertation Title: Statistical Uncertainty Analysis for Stochastic Simulation
  - Advisors: Barry L. Nelson, Russell R. Barton

NORTHWESTERN UNIVERSITY (NU), EVANSTON IL, USA

- M.S. Industrial Engineering and Management Sciences Aug. 2009

UNIVERSITY OF NEBRASKA-LINCOLN, LINCOLN NE, USA

- M.S. Computational Mechanics Aug. 2005
  - Thesis Title: Peridynamic Flux-Corrected Transport Algorithm for Shock Wave Studies
  - Advisor: Florin Bobaru
- Minor: Electrical Engineering

YANGTZE UNIVERSITY, JINGZHOU CHINA

- B.S. Mechanical Engineering June 1997

### Research Experience

- *Statistical Uncertainty Analysis for Stochastic Simulation* (Collaborate with Barry L. Nelson and Russell R. Barton) June 2011 – present
  - Supported by National Science Foundation

- When we use simulation to evaluate the performance of a stochastic system, the simulation often contains input models estimated from real-world data. There is both simulation and input uncertainty in the system performance estimate. We proposed two different approaches to quantify the overall uncertainty of the system mean performance estimate. One is the metamodel-assisted bootstrapping approach, which is a frequentist method and easy to implement for problems with both parametric and non-parametric input models. The second is a fully Bayesian framework, which provides a convenient way to incorporate prior information about the input-model parameters and the simulation mean response as a function of the input models. Both approaches can make effective use of the simulation budget. They are supported by rigorous theoretical analysis and demonstrate good finite-sample performance.
- *Marketing Analytics* (collaborate with Edward C. Malthouse) July 2013 – June 2014
  - The emergence of modern information and communication technologies including social media platforms, mobile devices and applications (apps) offers a multiplicity of touch points to engage customers with particular brands. By analyzing customer data from a well-known coalition loyalty program called the Canadian Air Miles Reward Program, we glean insights about how customer engagement through mobile apps affects the customer purchasing behavior. We employ a vector-autoregressive (VAR) model to account for the dynamic interactions among non-purchase customer engagement behaviors (i.e., app usage), purchase and consumption. The information extracted from our study can help marketers adjust their marketing strategy and improve their marketing effectiveness.
- *Stochastic Kriging: Modeling and Controlling Uncertainty in Simulation* (collaborate with Barry L. Nelson, Jeremy Staum) Aug. 2009 – June 2010
  - Supported by National Science Foundation
  - To correctly and efficiently predict the performance of expensive stochastic systems under various input settings, stochastic kriging was proposed, which is flexible and obtains significantly more benefit from a simulation investment through separately accounting for the sampling variability and response-surface uncertainty. Since the correlation function plays a critical role in both stochastic and kriging models, we studied various correlation functions in both spatial and frequency domains, and analyzed their impact on prediction accuracy.
- *Approximate Dynamic Programming in Complex Multi-Echelon Inventory and Production Systems* (collaborate with Diego Klabjan) Jan. 2008 – Aug. 2009
  - Supported by National Science Foundation
  - The goal of this project is to study the solution methodologies for general multi-echelon systems with stochastic lead-times, economies of scale, transportation capacities, and demand occurring in each stage of the system. Approximate dynamic programming was used to obtain shipping policies. Since the computation time can increase prohibitively for complex supply chain systems, various parallel algorithms based on Message Passing Interface were proposed to speed up the computation time.

- *Ground Penetrating Radar for Railroad Track Substructure Evaluation* (collaborate with Imad L. Al-Qadi, Douglas L. Jones) Aug. 2005 – Dec.2007
  - Supported by Federal Railroad Administration
  - To provide a fast and reliable evaluation over railroad track substructure system, we used a nondestructive testing method, Ground Penetrating Radar (GPR) with various frequency antennae, to obtain comprehensive information about the ballast thickness, fouling, and the condition of other subsurface layers. To automatically process the ultra-wideband signal collected through GPR, we proposed a data analysis approach based on short-time Fourier transform. On-site samples exhibited reliable and good performance of our approach in assessing railroad track substructure system situation.
- *Damage and Fracture with Peridynamics* (collaborate with Florin Bobaru ) Aug. 2003 – June 2005
  - The peridynamic formulation is a novel reformulation of the classical continuous mechanics theory and has strong ties with molecular dynamics models. This method leads to a meshfree implementation able to successfully model complicated fracture and fragmentation patterns at impact, spallation, etc. To simulate shock waves, the Flux-Corrected Transport technique was implemented in the peridynamic method leading to the Peridynamic Flux-Corrected Transport algorithm. This method can efficiently eliminate the high frequency oscillation behind the shock wave fronts and overcome limitations in the Finite Element Flux-Corrected method.

## **Technical Publication**

### *Journal Papers*

- Xie, W., B. L. Nelson, R. R. Barton. Multivariate Input Uncertainty in Output Analysis for Stochastic Simulation, working paper.
- Xie, W., B. L. Nelson, R. R. Barton. Statistical Uncertainty Analysis for Stochastic Simulation. under third revision for *Operations Research*.
- Xie, W., B. L. Nelson, R. R. Barton. A Bayesian Framework for Quantifying Uncertainty in Stochastic Simulation. accepted by *Operations Research*.
- Kim, S. J., V. Viswanathan, W. Xie, E. C. Malthouse, L. Hollebeek. Modeling Customer (Dis)engagement with Mobile Apps: A VAR Model Approach. submitted to *Journal of Marketing*.
- Barton, R. R., B. L. Nelson, W. Xie (2014). Quantifying Input Uncertainty via Simulation Confidence Intervals. *INFORMS Journal on Computing*, Vol. 26, No. 1, pp. 74-87.
- Pei, J., D. Klabjan, W. Xie (2013). Approximations to Auctions of Digital Goods with Share-averse Bidders. *Electronic Commerce Research and Applications*, Vol. 13, No. 2, pp. 128-138.
- Al-Qadi, I.L., W. Xie, R. Roberts (2010). Optimization of Antenna Configuration in Multiple-frequency Ground Penetrating Radar System for Railroad Substructure Assessment. *NDT & E International*, Vol. 43, No. 1, pp. 20-28.
- Al-Qadi, I.L., W. Xie, D.L. Jones, R. Roberts (2010). Development of a Time-Frequency Approach to Quantify Railroad Ballast Fouling Condition Using Ultra-Wide Band Ground-Penetrating Radar Data. *International Journal of Pavement Engineering*, Vol. 11, No. 4, pp.269-279.

- Al-Qadi, I.L., W. Xie, R. Roberts, Z. Leng (2010). Data Analysis Techniques for GPR Used for Assessing Railroad Ballast in High Radio-Frequency Environment, *Journal of Transportation Engineering*, Vol. 136, No. 4, pp.392-399.
- Al-Qadi, I.L., W. Xie, M.A. Elseifi (2008). Frequency Determination from Vehicular Loading Time Pulse to Predict Appropriate Complex Modulus in MEPDG. *Journal of the Association of Asphalt Paving Technologists*, Vol. 77, pp.739-772.
- Al-Qadi, I.L. , W. Xie, R. Roberts (2008). Scattering Analysis of Ground-Penetrating Radar Data to Quantify Railroad Ballast Contamination. *Journal of Nondestructive Testing and Evaluation*, Vol. 41, No. 6, pp.441-447.
- Al-Qadi, I.L. , W. Xie, R. Roberts (2008). Time-Frequency Approach for Ground Penetrating Radar Data Analysis to Assess Railroad Ballast Condition. *Research in Non-destructive Evaluation*, Vol. 19, No. 4, pp.219-237.
- Bobaru, F. , W. Xie (2008). A Flux-Corrected Transport Peridynamic Formulation for Impact and Spallation. submitted for publication.
- Xie, W., J. Xie (2003). Design of Mechanism Morphology and Mass Distribution for Control. *Machine Design and Research*, Vol. 19, No. 1, pp.31-33. (in Chinese)

#### Conference and Other Papers

- Xie, W, R. R. Barton, B. L. Nelson (2014). Statistical Uncertainty Analysis for Stochastic Simulation with Dependent Input Models. *Proceedings of the 2014 Winter Simulation Conference*.
- Xie, W, B. L. Nelson, J. Staum (2010). The Influence of Correlation Functions on Stochastic Kriging Metamodels. *Proceedings of the 2010 Winter Simulation Conference*.
- Barton, R. R., B. L. Nelson, W. Xie (2010). A Framework for Input Uncertainty Analysis. *Proceedings of the 2010 Winter Simulation Conference*.
- Al-Qadi, I.L., R. Roberts, E. Tutumluer, Z. Leng, W. Xie (2009). New Ground Penetrating Radar Analysis Techniques for Ballast Assessment. *Technology Digest TD-09-028*. AAR, TTCI, Pueblo, CO, USA.
- Al-Qadi, I.L. , W. Xie, R. Roberts (2008). Scattering Analysis of Railroad Ballast Using Ground-Penetrating Radar. *Transportation Research Board 86th Annual Meeting*.
- Beak, J., I.L Al-Qadi, W. Xie, W.G. Buttler (2008). In-Situ Assessment of Interlayer Systems to Abate Reflective Cracking in Hot-Mix Asphalt Overlays, *Transportation Research Board (TRB) 87th Annual Meeting*.
- Al-Qadi, I.L., W. Xie, R. Roberts (2007). Flaw Quantification of Railroad Ballast: A New Analysis Approach of Ground Penetrating Radar's Reflection Data, *86th TRB Annual Meetings*. Paper No.07-2273, Washington D.C., Jan 21-25, 2007.
- Popovics, J., N. Ryden, A. Gibson, I.L. Al-Qadi, D.S. Alzate, W. Xie (2007). New Developments in NDE Methods for Pavements. *AIP Conference Proceedings*.
- Xie, W., I.L. Al-Qadi, R. Roberts, E. Tutumluer, J. Boyle (2006). Quantification of Railroad Ballast Condition Using Ground Penetrating Radar Data. *6th International NDE Conference on Civil Engineering*.
- Al-Qadi, I.L. , J.S. Popovics, K. Jiang, W. Xie, G.P. Getrangolo (2006). Structural Assessment of Kingery Bridge Piers Using Combined Nondestructive Testing Methods. *6th International NDE Conference on Civil Engineering*.

## Technical Reports

- Xie, W., et al. (2011). Share Estimation and Uncertainty Quantification for Product Content Planning, Packaging and Pricing Optimization. General Motors.
- Al-Qadi, I.L., E. Tutumluer, W. Xie, R. Roberts (2007). Ground Penetrating Radar for Railroad Track Substructure Evaluation. Federal Railroad Administration.

## Project Proposal

- Partially involved in writing the proposal for NSF Grant (2010) “Quantifying Input Uncertainty in Stochastic Simulation.”
- Proposal to apply computer time on the Northwestern Quest cluster (2010).
- Proposal for NSF CMMI Research and Innovation Conference (2009).
- Proposal for AAR (2008) “Development of Short-time Fourier Transform Technique for GPR Assessment of Ballast Fouling.”

## Teaching Experience

### RENSELAER POLYTECHNIC INSTITUTE

- Teaching
  - ISYE 4140 Statistical Analysis Fall 2014

### NORTHWESTERN UNIVERSITY

- Co-teaching
  - IMC 451 Statistics and Marketing Research Fall 2013
- Teaching Assistant
  - IEMS 317 Discrete-Event Systems Simulation Fall 2012
  - IEMS 304 Statistical Methods for Data Mining Fall 2010
  - IEMS 202 Introduction to Probability Winter 2009

## Work Experience

### GENERAL MOTORS

- Summer Intern 2011
  - *Product Content Planning, Packaging and Pricing Project*

The objective of our project is to integrate customer preferences into an optimization framework to identify new vehicle content, packaging alternatives, and prices, to improve program aggregate contribution margin (ACM) and share. The customer preferences that drive the analysis are estimated using clinic data from a choice-based conjoint analysis. There are various sources of uncertainty in estimating the customer preferences. We identified these sources, and proposed different approaches to correctly and effectively propagate the part of estimation error which can be quantified to uncertainty about program ACM and share. This allows us to judge whether the expected performance under a certain decision setting is statistically significantly better than under another setting.

## SAN DIEGO SUPERCOMPUTER CENTER

- Summer Intern 2008
  - Supported by *Cyberinfrastructure Experiences for Graduate Students (CIEG) supplement funding*
  - Proposed and implemented various parallel approaches to find good shipping policies for complex multi-echelon inventory and production systems.

## CHENGDU CONSTRUCTION MACHINERY (GROUP) CO.

- Quality Supervisor 1997–1999
  - Control quality on assembly lines
  - Coordinate quality issues across different departments

## Presentations

- Statistical uncertainty analysis for stochastic simulation with dependent input models, Winter Simulation Conference, Savannah, GA, Dec. 2014.
- Multivariate input uncertainty in output analysis for stochastic simulation, INFORMS Annual Meeting, San Francisco, Nov. 2014.
- A Bayesian framework for quantifying uncertainty in stochastic simulation, INFORMS Annual Meeting, San Francisco, Nov. 2014.
- Modeling the effect of engagement and disengagement with mobile apps on customer purchase behavior, Marketing EDGE Professor's Institute, Cincinnati, Jan. 2014.
- Statistical uncertainty analysis for stochastic simulation, INFORMS Annual Meetings, Minneapolis, Oct. 2013.
- The fluence of correlation functions on stochastic kriging metamodels, Winter Simulation Conference, Baltimore, Dec. 2010.
- Approximate dynamic programming for serial multi-echelon system with economies of scale, INFORMS Annual Meeting, Washington DC, Oct. 2008.
- Development of a time-frequency approach to quantify railroad ballast fouling condition using UWB GPR data, Transportation Research Board, Washington DC, 2008.
- Scattering analysis of railroad ballast using ground penetrating radar, Transportation Research Board, Washington DC, 2007.
- Quantification of Railroad Ballast Condition Using Ground Penetrating Radar Data, 6th International NDE Conference on Civil Engineering, St. Louis, 2006.

## Honors and Awards

Graduate scholarship from the Transportation Research Forum Foundation in NU	2008	
The first-class scholarship in ME	Yangtze University	1995

First prize for college students

Hubei Advanced Mathematics Unified Examination 1993

### Service and Memberships

#### Referee

<i>Computers and Operations Research.</i>	2013
<i>Journal of Simulation.</i>	2012
<i>Journal of Materials in Civil Engineering.</i>	2008
<i>Nondestructive Evaluation.</i>	2008

#### Member

Institute for Operations Research and The Management Sciences (INFORMS)	2008,2013
Transportation Research Board	2006-2007