UTSAV AWASTHI

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EDUCATION

University of Connecticut   Storrs, CT
Ph.D., Chemical and Biomolecular Engineering   Expected August 2023
Advisor: Dr. George M. Bollas
Title: *Digital twin, hybrid modeling, and predictive analytics for system health monitoring in manufacturing*
Graduate Certificate in Advanced Systems Engineering   May 2022
Carnegie Mellon University   Pittsburgh, PA
M.S., Chemical Engineering   December 2017
Advisor: Dr. Ignacio E. Grossmann
Title: *Integration of Oilfield planning and Infrastructure optimization*
Indian Institute of Technology (BHU)   Varanasi, India
B.Tech., Chemical Engineering   May 2012

SKILLS

Programming	C, MATLAB, Python (PyTorch, Scikit-learn)
Software/Algebraic	PRO II, ASPEN, COMSOL, gPROMS, HTRI, ROMeo, CAD
modeling language	ALAMO, GPTIPS
Mathematical Programming/	Linear programming, Integer programming, Nonlinear programming,
Optimization	Mixed-integer nonlinear programming, Stochastic programming,
	Disjunctive programming
Machine learning/AI	Classification, Regression, Clustering, Dimensionality reduction,
	Genetic programming, Neural networks, Image segmentation
Data analytics	Data analysis, Data visualization, Data mining

RESEARCH INTERESTS

Digital twin, Hybrid modeling, Industry 4.0, Smart Manufacturing, Optimization, Process Engineering, Explainable-AI, Predictive Analytics

RESEARCH EXPERIENCE

University of Connecticut   Storrs, CT

Graduate Research Assistant   November 2019 – Present

- Formulated physics-inspired surrogate model, dynamic neural network and recursive models for tool wear prediction in manufacturing using symbolic regression and used these surrogate models as inferential sensor for fault classification.

- Developed and validated a digital twin model for milling to estimate the force, power consumption to use in building a supervisory controller, sensor suite and test settings selection, process health monitoring and hybrid models.

- Conducted design of experiments to design tests for data collection and model building.

- Collaborated with Connecticut center for advanced technology, USA, and IIT-Kharagpur, India, to conduct experiments for machining.

- Formulated a model-based methodology to determine optimal input test setting and sensors to isolate faults. Devised an algorithm to implement the input test setting and sensor selection as a mixed-integer nonlinear programming problem.

Carnegie Mellon University | Pittsburgh, PA

Research Assistant | December 2016 – June 2018

- Developed a multi-period nonlinear programming (NLP) model for maximizing the net present value (NPV) for oil production for reduced oil wells model for a time horizon of 20 years.

- Formulated a Bicriterion optimization model to find an ideal compromise solution between maximizing the NPV and maximizing the total oil production for the reduced model.

- Developed a multi-period mixed integer programming model with integer variable for piece-wise linear approximation to optimize of gas lift injection in the oil wells.

- Formulated an integrated oil well model with collocation to handle pressure drop in the oil wells.

TEACHING EXPERIENCE

University of Connecticut | Storrs, CT

Graduate Teaching Assistant | August 2018 – May 2019

CHEG 4147, Process Dynamics and Controls | January 2019 - May 2019
CHEG 3145, Chemical Engineering Numerical Analysis | August 2018 - December 2018

WORK EXPERIENCE

Reliance Industries Limited (RIL) | Mumbai, India

Technologist (Process optimization and control) | September 2013 – July 2016

- Configured models for petrochemical plants and refineries for their proficient and optimal functioning as well as performing process improvement and monitoring.

- Developed a reactor model for linear-low-desity-polyethylene (LLDPE) plant based on the molecular weight distribution of the polymer. The reaction kinetics model was built in Milano (programming language by Invensys).

- Modelled Kalman filter for a LLDPE reactor. The filter was built for controlling reactor parameters in case of grade changeover and normal operation.

- Simulated a model of Gasifier in a Coke gasification plant. Used the model to provide insights into selecting the grade of coke for the gasifier to meet the required business demand to the project development team.

- Developed Real-Time Optimization (RTO) Model for Gas Cracker. The model provided set points to the controllers to run the plant to optimum conditions based on the current pricing of products, utilities, and sources. The RTO model generates annual revenue of $2.5 million.

Plant operations | July 2012 – September 2013

- Monitored plan operations, participated in bi-annual maintenance of the plant in Mono Ethylene Glycol production plant at RIL, Hazira.

- Lead a team of plant members on a project to perform root cause analysis for a non-functioning of a vapor absorption machine.

- Saved $1.3 million, by identifying the fault in the vapor absorption machine and suggesting mitigating of the fault.

Axis Techsoft Solutions   Chandigarh, India

Team Lead and Content Developer   May 2009 – July 2011

- Worked as Team leader and content developer for a start-up venture -Axis Techsoft Solutions, an e-learning content, and tools development company.

PEER REVIEWED JOURNAL AND CONFERENCE PUBLICATIONS

Under preparation/Revisions/Submitted

1. **Awasthi, U.**, and Bollas, G. M. Physics-informed tool wear surrogate model and implicit tool wear rate surrogate model for milling. *(under preparation)*

2. Mishra, D., **Awasthi, U.**, Pattipati, K. R., and Bollas, G. M. Unsupervised Machine Learning for Tool Condition Monitoring in Precision Machining, to Journal of Intelligent Manufacturing. *(Submitted to Journal of Intelligent Manufacturing)*

Published/In-press/Accepted

3. **Awasthi, U.**, and Bollas, G. M. Application of grey-box modeling for machine state prediction in manufacturing. *(Accepted in Foundations of Computer Aided Process Operations/Chemical Process Control)*

4. **Awasthi, U.**, and Bollas, G. M. Symbolic regression-based method for developing a physics-informed surrogate model for a manufacturing process. *(Accepted in 33rd European Symposium on Computer-Aided Process Engineering)*

5. **Awasthi, U.**, Wang, Z., Mannan, N., Pattipati, K. R., and Bollas, G. M. (2022). Physics-based modeling and information-theoretic sensor and settings selection for tool wear detection in precision machining. Journal of Manufacturing Processes, 81, 127–140.

6. Wilson, P. J., Shen Z., **Awasthi, U.**, Bollas, G. M., Gupta, and S. (2022). Multi-Objective Supervisory Framework for Minimizing Expected Costs and Increasing Reliability in Precision Machining. Journal of Advanced Manufacturing and Processing: Special Edition on CESMII.

7. Yang, Q., Pattipati, K. R., **Awasthi, U.**, and Bollas, G. M. (2022). Hybrid data-driven and model-informed online tool wear detection in milling machines. Journal of Manufacturing Systems, 63, 329–343.

8. **Awasthi, U.**, and Bollas, G. M. (2020). Sensor network design for smart manufacturing – Application on precision machining. IFAC PapersOnLine, 53(2), 11440–11445.

9. **Awasthi, U.**, Palmer, K. A., and Bollas, G. M. (2020). Optimal test and sensor selection for active fault diagnosis using integer programming. Journal of Process Control, 92, 202–211.

10. **Awasthi, U.**, Marmier, R., and Grossmann, I. E. (2019). Multiperiod optimization model for oilfield production planning: bicriterion optimization and two-stage stochastic programming model. Optimization and Engineering.

TALKS, AND PRESENTATIONS

1. **Awasthi, U.**, and Bollas, G. M (2023). Symbolic regression-based method for developing a physics-informed surrogate model for a manufacturing process, 33rd European Symposium on Computer-Aided Process Engineering, Athens, Greece. *(Accepted)*

2. **Awasthi, U.**, and Bollas, G. M (2023). Application of grey-box modeling for machine state prediction in manufacturing, Foundations of Computer Aided Process Operations/Chemical Process Control, San Antonio, USA. *(Accepted)*

3. **Awasthi, U.**, and Bollas, G. M. (2022). Physics-Informed Surrogate Models for Manufacturing Applications, AIChE, Phoenix, USA.

4. **Awasthi, U.**, Pattipati, K. R., and Bollas, G. M. (2022). Physics-Inspired inferential sensor for tool wear classification in milling, Advanced Manufacturing and Processing Conference, Bethesda, MD, USA. *(Invited talk)*

5. **Awasthi, U.**, and Bollas, G. M. (2022). Digital twin and surrogate model for tool wear prediction, Student Association of Graduate Engineers, University of Connecticut, Storrs, USA. *(Poster)*

6. **Awasthi, U.**, and Bollas, G. M. (2021). Fault detection in CNC machines, Student Association of Graduate Engineers, University of Connecticut, Storrs, USA. *(Poster)*

7. **Awasthi, U.**, Tom Maloney, and Bollas, G. M. (2020). Maintenance Testing in Precision Machining, AIChE, Virtual Meeting, USA.

8. **Awasthi, U.**, and Bollas, G. M. (2020). Sensor Network Design for Smart Manufacturing - Application on Precision Machining, IFAC (Vitrual), Berlin, Germany.

9. **Awasthi, U.**, and Bollas, G. M. (2019). Physics-based models for precision machining, AIChE, Orlando, USA.

10. **Awasthi, U.**, Palmer, K. A., and Bollas, G. M. (2019). Sensor and test selection for Passive & Active fault diagnosis, AIChE, Orlando, USA.

11. **Awasthi, U.**, and Bollas, G. M. (2019). Optimal test design and sensor selection for active FDI, INCOSE conference, University of Connecticut, Storrs, USA. *(Poster)*

12. **Awasthi, U.**, Marmier, R., and Grossmann, I. E. (2017). Optimization of production and gas lift for oil wells, Mathais, Paris, France.

13. **Awasthi, U.**, Marmier, R., and Grossmann, I. E. (2017). Oilfield planning, CAPD conference, Pittsburgh, USA. *(Poster)*

14. **Awasthi, U.**, Marmier, R., and Grossmann, I. E. (2017). Oilfield planning optimization, Enterprise-wide optimization conference, Pittsburgh, USA.

AWARDS, GRANTS, FELLOWSHIPS, AND SERVICE

General Electric Fellowship of Excellence	2022 - 2023
Fellowship for Linear and Non-Linear Mixed Integer Optimization workshop, ICERM, Brown University	2023
Foundations of Computer Aided Process Operations/Chemical Process Control Travel Award	2023
AIChE Three Minute Thesis Finalist	2022
University of Connecticut Three Minute Thesis Finalist	2022
Chemical and Biomolecular Engineering Predoctoral Fellowship, University of Connecticut	2022
John Lof Leadership Academy Conference Travel Award, University of Connecticut	2022
Conference Participation Award, Graduate School, University of Connecticut	2022
Judge for AIChE Undergraduate poster competition *(volunteer)*	2022

UTC-Institute of Advanced Systems Engineering graduate fellow   2018-2023

LEADERSHIP

University of Connecticut	Storrs, CT
Treasurer, John Lof Leadership Academy	2021 – 2022
Member, John Lof Leadership Academy	2020 – 2022
Department Senator, Graduate Student Senate	2019 – 2020
Treasurer, TARANG, South Asian Graduate Student Organization	2019 - 2020
Senator At-Large, Graduate Student Senate	2019 – 2020

WORKSHOPS/CERTIFICATIONS

Introduction to Quantum computing, Qubit x Qubit, sponsored by IBM Quantum	2021 – 2022

PROFESSIONAL MEMBERSHIPS

American Institute of Chemical Engineers (AIChE)
Society of Industrial and Applied Mathematics (siam)
INFORMS
INCOSE
IEEE