Seshu Kumar Damarla
Research Associate
Chemical and Materials Engineering
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Research Associate with research interests in Process Data Analytics, Control Loop Performance Monitoring, Soft Sensors, Process Control, Process Monitoring and Machine Learning.

Experience

Research Associate (August 2023 – present)

Chemical and Materials Engineering, University of Alberta, Edmonton, Alberta, Canada

Supervisor: Prof. Biao Huang

Industrial Researcher (January 2019 – July 2023)

Syncrude Canada Ltd., Fort McMurray, Alberta, Canada

Chemical and Materials Engineering, University of Alberta, Edmonton, Alberta, Canada

Academic Supervisor: Prof. Biao Huang

Industry Supervisor: Ashish Shah, Manager, Automation

Academic Experience

August 2017-July 2018	Assistant Professor Department of Chemical Engineering, C. V. Raman College of Engineering, Bhubaneswar, Odisha, India
August 2011-December 2011	Assistant Professor Department of Chemical Engineering, Maulana Azad National Institute of Technology Bhopal, India

Industrial Research Projects

I worked on the following industrial research projects to improve process operations in oil sands industries: Syncrude Canada Ltd., Suncor Energy Inc., Shell Canada and Nutrien.

- Developed and deployed soft sensors (predictive models) for estimating the ratio of naphtha and bitumen in the feed stream of centrifuges in extraction facility at Syncrude Canada Ltd.
- Devised an empirical approach for detection of sanding in hydro-transport pipelines in the slurry preparation plant at Syncrude Canada Ltd.

- Designed data-reconciliation based method for correcting the readings of weightometer in the dry ore preparation plant at Syncrude Canada Ltd.
- Formulated multivariate statistical techniques-based method for detection of foaming in amine contactors in upgrading facility at Syncrude Canada Ltd.
- Developed inferential models using Near Infrared Spectroscopy data to predict gasoline properties, enhancing product quality control for Suncor Energy Inc.
- Led an Advanced Process Control Decision Support project for Shell Canada, aiding control engineers in interpreting operator actions on critical process variables.
- Developed a graphical user interface to extract data from the screenshot (image) of distributed control system, and identify process models that are subsequently used to design PI/PID controller (This project is being carried out for Nutrien)

Research Interests

- Control Loop Performance Monitoring
- Soft Sensors (Inferential Models or Virtual Sensors)
- Process Monitoring
- Machine Learning
- Process Data Analytics
- Process Control
- Generative AI in Process Systems Engineering
- Reinforcement Learning for autonomous control

Programming Skills

- Python (Scikit-learn, TensorFlow, PyTorch, SciPy)
- MATLAB
- SQL

Professional Certificates

- Machine Learning (Coursera, October 2021)
- Deep Learning Specialization (Coursera, June 2022)
- SQL for Data Science (Coursera, July 2023)
- Microsoft Power BI Data Analyst (Coursera, October 2024)

Research Publications

Patent

Seshu Kumar Damarla, Xi Sun, Biao Huang, Fangwei Xu, Ashish Shah, Joseph Amalraj. Method for detecting and quantifying valve stiction in process control loops. US Patent, US20240376998A1, 14 May 2023. https://patents.google.com/patent/US20240376998A1/en

Books

- Seshu Kumar Damarla, Madhusree Kundu. Fractional Order Processes: Simulation, Identification and Control. CRC Press, Taylor & Francis Group, United States, 2018 (ISBN: 9781138586741). https://www.taylorfrancis.com/books/mono/10.1201/9780429504433/fractional-order-processes-madhusree-kundu-seshu-kumar-damarla
- Madhusree Kundu, Palash Kumar Kundu, Seshu Kumar Damarla. Chemometric Monitoring: Product Quality Assessment, Process Fault Detection, and Applications. CRC Press, Taylor & Francis Group, United States, 2017. (ISBN: 9781138746213). https://www.taylorfrancis.com/books/mono/10.1201/9781315155135/chemometric-monitoring-madhusree-kundu-palash-kumar-kundu-seshu-damarla

Publications in Refereed Journals

- Arijit Ghosh, Seshu K. Damarla, Palash Kundu (2025). Identification of Illuminance Grade using Autoencoder based Quadratic Discriminant Analysis. Lighting Research & Technology (under review)
- Chayan Kumar Basak; Seshu Kumar Damarla; Palash Kumar Kundu (2025). Application of Convolutional Neural Network to Classify Thermal Tomographic Images for Heating Assessment. Journal of The Institution of Engineers (India): Series B (under review).
- Xiuli Zhu, Seshu Kumar Damarla, Kuangrong Hao, Biao Huang, Peng Wang, Fan Guo (2025). Robust Soft Sensor Modeling with Contractive Enhanced Adaptive Variational Autoencoder. Measurement (under review)
- Yujun Chen, Xiuli Zhu, Seshu kumar Damarla, Peng Wang, Kuangrong Hao, Derui Ding, Yan Song, Biao Huang (2025). Adaptive Variational Dual-stream Graph Convolutional Networks Aware Data-driven Modeling for Complex Industrial Process. IEEE Transaction on Industrial Electronics (under review)
- Damarla, S.K.; Kundu, M. (2025). A Unified Framework Using Orthogonal Hybrid Functions for Solving Linear and Nonlinear Fractional Differential Systems. AppliedMath (in press).
- Malhar Barbhaya, Purushottama Rao Dasari, Seshu Kumar Damarla, Rajagopalan Srinivasan, Biao Huang (2025). A Deep Learning Framework for Cyberattack Detection and Classification in Industrial Control Systems. Computers and Chemical Engineering, Vol. 202, November 2025, 109278
- Zahra H., Seshu K. Damarla, Biao Huang (2025). A Novel Toeplitz Matrix and CNN-LSTM Based Method for Identifying Control Valve Stiction. Industrial & Engineering Chemistry Research, Vol. 64 (34), pp. 16757-16769, 2025.
- Damarla, S.K.; Kundu, M. (2025). Novel Hybrid Function Operational Matrices of Fractional Integration: An Application for Solving Multi-Order Fractional Differential Equations. AppliedMath **2025**, 5, 55. https://doi.org/10.3390/appliedmath5020055.
- Xiuli Zhu, Jiajun Xu, Zixuan Fu, Seshu Kumar Damarla, Peng Wang, Kuangrong Hao (2025). Novel Dynamic Data-Driven Modeling Based on Feature Enhancement with Derivative Memory LSTM for Complex Industrial Process. Neurocomputing, Vol. 626, 14 April 2025, 129619.

- Amirreza Memarian, Seshu Damarla, Alireza Memarian, Biao Huang (2024). Detection of poor controller tuning with Gramian Angular Field (GAF) and Stack Autoencoder (SAE). *Computers and Chemical Engineering*, Volume 185, 108652. https://doi.org/10.1016/j.compchemeng.2024.108652
- Amirreza Memarian, Seshu Damarla, Biao Huang, Zheng and Han, Mik Marvan (2024). Shape-based pattern recognition approaches toward oscillation detection. *Ind. Eng. Chem. Res.,* Vol. 63 (9), pp. 4018-4029. https://doi.org/10.1021/acs.iecr.3c03077
- Nathan P. Lawrence, Seshu Kumar Damarla, Jong Woo Kim, Aditya Tulsyan, Faraz Amjad, Kai Wang, Benoit Chachuat, Jong Min Lee, Biao Huang, R. Bhushan Gopaluni (2024). Machine learning for industrial sensing and control: A survey and practical perspective. *Control Engineering Practice*, Vol. 145, pp. 105841. https://doi.org/10.1016/j.conengprac.2024.105841
- Amirreza Memarian, Seshu Kumar Damarla, Biao Huang (2023). Control Valve Stiction Detection using Markov Transition Field and Deep Convolutional Neural Network. *Can. J. Chem. Eng.*, Vol. 101(11), pp. 6114-6125. https://doi.org/10.1002/cjce.25054
- Seshu K. Damarla, Xi Sun, Fangwei Xu, Ashish Shah, Biao Huang (2023). Statistical tests based practical methods for detection and quantification of stiction in control valves. *Ind. Eng. Chem. Res.* Vol. 62 (10), pp. 4410−4421. *https://doi.org/10.1021/acs.iecr.2c03564*.
- Xiuli Zhu, Seshu Kumar Damarla, Kuangrong Hao, Biao Huang, Hongtian Chen, Yicun Hua (2023). ConvLSTM and Self-Attention aided Canonical Correlation Analysis for Multi-output Soft Sensor Modeling. *IEEE Transactions on Instrumentation & Measurement*, Vol. 72, 2503810. https://doi.org/10.1109/TIM.2022.3225004
- Seshu K. Damarla, Xi Sun, Fangwei Xu, Ashish Shah, Joseph Amalraj, Biao Huang (2021). Practical Linear Regression-Based Method for Detection and Quantification of Stiction in Control Valves. *Industrial & Engineering Chemistry Research,* Vol. 61, pp. 502-514. https://doi.org/10.1021/acs.iecr.1c02723.
- Ling Li, Seshu Kumar Damarla, Yalin Wang, Biao Huang (2021). A Gaussian Mixture Model Based Virtual Sample Generation Approach for Small Datasets in Industrial Processes. *Information Sciences*, Vol. 581, pp. 262-277. https://doi.org/10.1016/j.ins.2021.09.014.
- Xiuli Zhu, Seshu Damarla, Kuangrong Hao, Biao Huang (2021). Parallel Interaction Spatiotemporal Constrained Variational Autoencoder for Soft Sensor Modeling. *IEEE Transactions on Industrial Informatics*, vol. 18(8), pp. 5190-5198. https://doi.org/10.1109/TII.2021.3110197
- Da Zheng, Xi Sun, Seshu K. Damarla, Ashish Shah, Joseph Amalraj, Biao Huang (2021). Valve Stiction Detection and Quantification Using K-means Clustering Based Moving Window Approach. *Industrial & Engineering Chemistry Research*, Vol. 60(6), pp. 2563-2577. https://doi.org/10.1021/acs.iecr.0c05609.

- Seshu Kumar Damarla, Madhusree Kundu (2020). Piecewise Linear Approximate Solution of Fractional Order Non-Stiff and Stiff Differential-Algebraic Equations by Orthogonal Hybrid Functions. *Progress in Fractional Differentiation and Applications*, Vol. 6(3), pp. 183-200. https://doi:10.18576/pfda/060303
- Seshu Kumar Damarla, Madhusree Kundu (2017). Generalized Mathematical Mode of Chronic Hepatitis C Infection. *Journal of Fractional Calculus and Applications*, Vol. 8(2), pp. 1-19. https://doi:10.21608/JFCA.2017.308417
- Seshu Kumar Damarla, Madhusree Kundu (2015). Design of Robust Fractional PID Controller using Triangular Strip Operational Matrices. *Fractional Calculus and Applied Analysis*, Vol. 18, No 5, pp. 1291–1326, DOI: 10.1515/fca-2015-0074. https://doi.org/10.1515/fca-2015-0074.
- Seshu Kumar Damarla, Madhusree Kundu (2015). Numerical Solution of Multi-order Fractional Differential Equations using Generalized Triangular Function Operational Matrices. *Applied Mathematics and Computation*, Vol. 263, pp. 189 – 203. https://doi.org/10.1016/j.amc.2015.04.051.
- Seshu Kumar Damarla, Madhusree Kundu (2015). Numerical Solution of Fractional Order Differential-Algebraic Equations using Generalized Triangular Operational Matrices. *Journal of Fractional Calculus and Applications*, Vol. 6(2), pp. 31 – 52. https://doi:10.21608/JFCA.2015.306013
- Seshu Kumar Damarla, Madhusree Kundu (2014). Approximate Solution of Nonlinear Fractional Order Biochemical Reaction Model by Multistage New Iterative Method. *Journal of Fractional Calculus and Applications*, Vol. 5(2), pp. 107 – 120. https://doi:10.21608/JFCA.2014.287265
- Seshu Kumar Damarla, Madhusree Kundu (2013). Decoupling multivariable processes using partial least squares for decentralized control. *International Journal of Computer Applications*, Vol. 64(5), pp. 5 – 12. https://doi.org/10.5120/10628-5356
- Seshu Kumar Damarla, Madhusree Kundu (2013). Control of yeast fermentation bioreactor in subspace. *International Journal of Computer Applications*, Vol. 64(5), pp. 13 – 20. https://doi.org/10.5120/10629-5357
- Seshu Kumar Damarla, Madhusree Kundu (2011). Monitoring of drum-boiler process using statistical techniques. *International Journal of Chemical Engineering and Applications*, Vol. 2(3), pp. 173-180. https://doi.org/10.7763/IJCEA.2011.V2.97
- Seshu Kumar Damarla, Madhusree Kundu (2011). Monitoring of Bioreactor using Statistical Techniques. *International Science Congress Association*, Vol. 1(3), pp. 114-119.
- Seshu Kumar Damarla, Madhusree Kundu (2011). Identification and Control of Distillation Process using Partial Least Squares based Artificial Neural Network. *International Journal of Computer Applications*, Vol. 29(7), pp. 29-35. https://doi.org/10.5120/3576-4936

- Seshu Kumar Damarla, Palash Kumar Kundu (2011). Classification of Unknown Thermocouple Type using Similarity Factor Measurement. *Sensors and Transducers*, Vol. 124(1), pp. 11-18.
- Seshu Kumar Damarla, Madhusree Kundu (2010). Design of Multivariable Neural Controllers using a Classical Approach. *International Journal of Chemical Engineering and Applications*, Vol. 1(2), pp. 165-172. https://doi.org/10.7763/IJCEA.2010.V1.29

Conference Proceedings

- Andre Paulo Ferreira Machado, Biao Huang, Seshu Damarla, adeyinka Opadeyi, Bo Li. Foaming Prediction for CO2 Removal Absorber Column. 20th IFAC Symposium on Control, Optimization and Automation in Mining, Mineral and Metal Processing, 22-24 October 2025, Lima, Peru.
- Alireza Memarian, Amirreza Memarian, Seshu Damarla, Biao Huang. Reservoir computing-based slow feature analysis: Application in fault classification. *The 12th IFAC Symposium on Advanced Control of Chemical Processes (ADCHEM 2024)*, Hyatt Regency Toronto, Canada, July 14-17, 2024.
- Seshu Kumar Damarla, Biao Huang. Control Valve Stiction Detection using Learning Vector Quantization Neural Network. *The 12th IFAC Symposium on Advanced Control of Chemical Processes (ADCHEM 2024)*, Hyatt Regency Toronto, Canada, July 14-17, 2024.
- Seshu Kumar Damarla, Palash Kumar Kundu. CNN and MLR based Multifunction Sensor Development using Piezo-resistive Element. *The 7th Joint International Conference on Data Science & Management of Data*, IIIT Bangalore, India, January 4-7, 2024. https://doi.org/10.1145/3632410.3632492
- Seshu Kumar Damarla. Electronic Tongue based Classification of Mineral Water Samples using Gramian Angular Field and Deep SAE. *The 7th Joint International Conference on Data Science & Management of Data*, IIIT Bangalore, India, January 4-7, 2024. https://doi.org/10.1145/3632410.3632473
- Xiuli Zhu, Seshu Kumar Damarla, Biao Huang. Estimation of minimum miscibility pressure in impure/pure N2 based enhanced oil recovery process: A comparative study of statistical and machine learning algorithms. 2023 *The 6th International Conference on Robotics, Control and Automation Engineering (RCAE 2023)*, Suzhou, China, November 3-5, 2023. https://doi.org/10.1109/RCAE59706.2023.10398818
- Amirreza Memarian, Seshu Kumar Damarla, Biao Huang. Shape-based pattern recognition approach toward plant-wide oscillation detection. *Canadian Chemical Engineering Conference (CSChE 2023)*, October 29 – November 01, 2023, Calgary, Canada.
- Xiuli Zhu, Seshu Kumar Damarla, Biao Huang. Spatiotemporal Stacked Autoencoder Based Soft Sensor Modeling for the Dow Data Challenge Problem. *The 20th IEEE International Conference on Ubiquitous Intelligence and Computing (UIC 2023)*, University of Portsmouth, Portsmouth, UK, August 28-31, 2023.
- Seshu Damarla, Xiuli Zhu, Madhusree Kundu. Electronic Tongue based Classification of Mineral Water Samples using Markov Transition Field and CNN. *The 6th Joint International*

Conference on Data Science & Management of Data, IIT Bombay, India, January 4-7, 2023. https://doi.org/10.1145/3570991.3571003

- Seshu Kumar Damarla, Madhusree Kundu. Novel hybrid function operational matrices of fractional integration: An application for solving multi-order fractional differential equations. *National Conference on Recent Developments in Fractional Calculus and its Applications*, Sastra University, India, November 18-19, 2022.
- Amirreza Memarian, Seshu Kumar Damarla, Biao Huang. Shape-based pattern recognition approach toward plant-wide oscillation detection. *Canadian Chemical Engineering Conference (CSChE 2022)*, Vancouver, Canada, October 23-26, 2022.
- Seshu K. Damarla, Xi Sun, Fangwei Xu, Ashish Shah, Biao Huang. A Sigmoid Function based Method for Detection of Stiction in Control Valves. *In Proceedings of 7th International Symposium on Advanced Control of Industrial Processes*, 7-9 August 2022, University of British Columbia, Canada. https://doi.org/10.1109/AdCONIP55568.2022.9894234
- Seshu Kumar Damarla, Xiuli Zhu, Madhusree Kundu. Classification and Authentication of Mineral Water Samples using Electronic Tongue and Deep Neural Networks. *In Proceedings of 2021 IEEE Third International Conference on Cognitive Machine Intelligence (CogMI)*, 12-14 December 2021, University of Pittsburgh, USA. https://doi.org/10.1109/CogMI52975.2021.00011
- Seshu Kumar Damarla, Madhusree Kundu. Classification of Tea Samples using Learning Vector Quantization Neural Network. *In Proceedings of IEEE Applied Signal Processing Conference (ASPCON)*, 07 October 2020, Jadavpur University, Kolkata, India. https://doi.org/10.1109/ASPCON49795.2020.9276662
- R. Bhushan Gopaluni, Aditya Tulsyan, Benoit Chachuat, Biao Huang, Jong Min Lee, Faraz Amjad, Seshu Kumar Damarla, Jong Woo Kim, Nathan P. Lawrence. Modern Machine Learning Tools for Monitoring and Control of Industrial Processes: A Survey. *IFAC World Congress*, 20 July 2020, Berlin, Germany. https://doi.org/10.1016/j.ifacol.2020.12.126
- Seshu Kumar Damarla, Madhusree Kundu. Monitoring Semi-batch Reactor using Principal Component Analysis. *IEEE International Conference on Emerging Trends in Electrical Engineering and Energy Management (ICETEEEM-2012)*, 13-15 December 2012, Aarupadai Veedu Institute of Technology, Tamilnadu, India. https://doi.org/10.1109/ICETEEEM.2012.6494434
- Seshu Kumar Damarla, Madhusree Kundu. Online Monitoring of Chromium Sludge Recycling Process using Recursive MPCA. *IEEE International Conference on Emerging Trends in Electrical Engineering and Energy Management (ICETEEEM-2012)*, 13-15 December 2012, Aarupadai Veedu Institute of Technology, Tamilnadu, India. https://doi.org/10.1109/ICETEEEM.2012.6494435
- K.S. Kaushikaram, Seshu Kumar Damarla, C. Kavuri, Madhusree Kundu. Partial Least Squares: Application in Classification and Multivariable Process Dynamics Identification. *Indian Chemical Engineering Congress (CHEMCON-2010)*, 27-29 December 2010, Annamalai University, Chidambaram, India.

- Seshu Kumar Damarla, Madhusree Kundu. Design of Neural Controllers for MIMO System. *ChEmference 2010*, 13-14 July 2010, Indian Institute of Technology Kanpur, India.

LinkedIn Profile

https://www.linkedin.com/in/seshu-kumar-damarla-a46068198/

GitHub Profile

https://github.com/seshu-damarla

Google Scholar Profile

https://scholar.google.ca/citations?hl=en&pli=1&authuser=1&user=KhS5aKIAAAAJ

Scopus Profile

https://www.scopus.com/authid/detail.uri?authorId=36933962400

Web of Science Profile

https://www.webofscience.com/wos/author/record/ISV-2250-2023

Academic Qualifications

2012-2018	Doctor of Philosophy Department of Chemical Engineering, National Institute of Technology, Rourkela, Odisha, India.
2009-2011	Master of Technology, Department of Chemical Engineering, National Institute of Technology, Rourkela, Odisha, India.
2004-2008	Bachelor of Technology, Department of Chemical Engineering, Bapatla Engineering College, Bapatla, Andhra Pradesh, India.

Mentoring Experience

I have mentored or am mentoring the following students for thesis research work in the fields of soft sensors, control loop performance monitoring and process monitoring.

- Ling Li (Visiting PhD student, from 2020 to 2021)
- Xiuli Zhu (Visiting PhD student, from 2021 to 2022)
- Amirreza Memarian (Master student, from 2021 to 2023)
- Zahra Hajimehdigholi (Current master student)
- Malhar Barbhaya (current co-op student)

Professional Service

Young Advisory Editor, Engineering Reports, Wiley
Associate Editor, IEEE Transactions on Industrial Informatics

Reviewer

- Control Engineering Practice
- Engineering Applications of Artificial Intelligence
- ISA Transactions
- Measurement
- Advanced Engineering Informatics
- IEEE Transactions on Industrial Informatics
- European Journal of Control
- Canadian Journal of Chemical Engineering
- IEEE Transactions on Industrial Cyber-Physical Systems
- ACS Omega
- Journal of Mathematics
- Technical program committee member for rtip2r conference (https://rtip2r-conference.org)