Dr. Soumyajit Sen Gupta

Designation: Assistant Professor

Department of Chemical Engineering

Indian Institute of Technology (Indian School of Mines), Dhanbad

Past Experience:

- Postdoctoral Associate (February 2018 – June 2021)
  Department of Mechanical and Aerospace Engineering, University of Florida, USA

  Member, System Design and Integration Division, Center for the Utilization of Biological Engineering in Space, National Aeronautics and Space Administration (NASA)

Academic Qualification

- Doctor of Philosophy (2018) CGPA: 8.93/10.00
  Department of Chemical Engineering, Indian Institute of Technology Bombay
- Master of Technology (2012) CGPA: 9.89/10.00
  Department of Chemical Engineering, Indian Institute of Technology Kharagpur
- Bachelor of Engineering (2010) CGPA: 9.0/10.0 (84.34 %)
  Department of Chemical Engineering, Jadavpur University

Research Experience

- **Postdoctoral Research**

  - ✓ Optimized design and operation scheduling for biological manufacturing on Mars surface based on an integrated end-to-end optimization model, coded on Python, correlating the insitu resources, supply from earth and demand of the crew members
  - ✓ Extensive optimization of parameters for some of the key processes such as anaerobic digestion of mission wastes
  - ✓ Dynamic modeling of individual biochemical processes with experimental data from collaborators across partner Universities and integration of such models for process scheduling
  - ✓ Computational approaches for large scale Mixed Integer Programming

- **Doctoral Research**

  Title: Integrated plant-wide optimization of algal biorefinery using a model-based approach

  Highlights:

  ✓ Applied superstructure optimization to study integrated microalgae biorefinery

  ✓ Developed a Mixed Integer Linear Programming model in GAMS

  ✓ Addressed potentially bilinear terms in the model with standard techniques

  ✓ Incorporated strategies for optimal scheduling of various operations and sizing of equipment alongside variation in product demand and selling price profiles

- **Research Internship: (July, 2015- November, 2015)**

  Title: Optimal scheduling of crane operations in steel-coil yard

  Host organization: ABB Global Industries and Services Private Limited, Bengaluru

  Highlights:

  ✓ Applied optimization technique to study crane operation in a yard under various conditions

  ✓ Developed a Mixed Integer Quadratic Programming model in MATLAB

- **M.Tech. Thesis:**

  Title: Modelling of thermite-based boiler reactor for naval application

  Project of Naval Science and Technological Laboratory (NSTL), Defense Research and Development Organization (DRDO)

- **B.E. Project:**

  Title: Software Development for pipe flow network design & analysis

Industrial Experience

- **In-plant training** at Chloralkali and Sulphuric acid plants at 'Hindusthan Heavy Chemicals', Khardaha, West Bengal in June, 2009

Research Interest

- Process Systems Engineering – Optimization and Control for Design and Scheduling of integrated processes
- Computational approaches for large scale optimization models
- Artificial Intelligence in Chemical Engineering
- Sustainability assessment
- Novel pathways for efficient usage of conventional energy sources

Publications

Peer-reviewed Journal Publications

- Aaron J. Berliner, Jacob M. Hilzinger, Anthony J. Abel, Matthew J. McNulty, George Makrygiorgos, Nils J. H. Averesch, Soumyajit Sen Gupta, et al. Towards a biomanufactory on Mars. Frontiers in Astronomy and Space Sciences, 8:711550, July 2021.
- Soumyajit Sen Gupta, Yogendra Shastri, Sharad Bhartiya. Integrated microalgae biorefinery: Impact of product demand profile and prospect of carbon capture. Biofuels, Bioproducts & Biorefining 2017; 11(6):1065-1076.
- Soumyajit Sen Gupta, Yogendra Shastri, Sharad Bhartiya. Optimization of integrated microalgal biorefinery producing fuel and value-added products. Biofuels, Bioproducts & Biorefining 2017; 11(6): 1030-1050.
- Soumyajit Sen Gupta, Yogendra Shastri, Sharad Bhartiya. Model-based optimization of biodiesel production from microalgae. Computers & Chemical Engineering 2016; 89: 222-249.
- Soumyajit Sen Gupta, Sharad Bhartiya, Yogendra Shastri. The practical implementation of microalgal biodiesel: challenges and potential solutions. CAB Reviews 2014; 9, 020:1-12.

Publications under preparation

- Soumyajit Sen Gupta, Amor A Menezes. Mars Colony Manufacturing: Optimal Extraterrestrial Abiotic-Biotic Factory Design and Operation
- Soumyajit Sen Gupta, Alexander J Benvenuti, Amor A Menezes. Loop closure in Mars biomanufacturing factory via anaerobic digestion strategies

Book Chapters

- Soumyajit Sen Gupta, Yogendra Shastri, Sharad Bhartiya. Optimization of the Integrated Downstream Processing of Microalgae for Biomolecule Production. In Kalyan Gayen, Tridib Kumar Bhowmick, Sunil Kumar Maity (Eds.), Sustainable Downstream Processing of Microalgae for Industrial Application (ISBN 9780815353607), CRC Press, 2019, 317-350.

Peer-reviewed Conference Proceedings

- George Makrygiorgos, Soumyajit Sen Gupta, Amor A. Menezes, Ali Mesbah. Fast probabilistic uncertainty quantification and sensitivity analysis of a Mars life support system model. In *Proceedings of the 21st IFAC World Congress*, July 12-17, 2020.
- Saige R. Drecksler, Soumyajit Sen Gupta, Alexander J. Benvenuti, Amor A. Menezes. Effects of space biomanufacturing on fuel production alternatives for exploration missions. In *Proceedings of the International Conference on Environmental Systems*, number ICES-2020-499, July 12-16, 2020.
- Alexander J. Benvenuti, Saige R. Drecksler, Soumyajit Sen Gupta, Amor A. Menezes. Design of anaerobic digestion systems for closed loop space biomanufacturing. In *Proceedings of the International Conference on Environmental Systems*, number ICES-2020-498, July 12-16, 2020.
- Soumyajit Sen Gupta, Yogendra Shastri, Sharad Bhartiya. Impact of protein co-production on techno-economic feasibility of microalgal biodiesel. In *26th European Symposium on Computer Aided Process Engineering (ESCAPE 2016)*, Portorož, Slovenia; June 12-15, 2016. Computer-Aided Chemical Engineering 38 (B): 1803- 1808.
- Soumyajit Sen Gupta, Sharad Bhartiya, Yogendra Shastri. Biodiesel from microalgae: Model-based optimized process synthesis. ChemCon 2015. 68th Annual Session of Indian Institute of Chemical Engineers (IIChE), Guwahati, India; December 27-30, 2015.
- Soumyajit Sen Gupta, Sharad Bhartiya, Yogendra Shastri. Model-based Optimisation of Integrated Algae Biorefinery. In Advances in Control and Optimization of Dynamical Systems (ACODS), Kanpur, India; March 13-15, 2014. Proceedings of the 3rd International Conference on Advances in Control and Optimization of Dynamical Systems: 1011–1018.

Conference Presentations

- Soumyajit Sen Gupta, Sharad Bhartiya, Yogendra Shastri. Co-production of biodiesel and protein from microalgae: a superstructure optimization study. ICRABR 2016. 2nd International Conference on Recent Advances in Bio-energy Research, Sardar Swaran Singh National Institute of Bio Energy, Kapurthala, India; February 25-27, 2016.
- Soumyajit Sen Gupta, Yogendra Shastri, Sharad Bhartiya. Optimisation of integrated microalgal biorefinery coproducing biodiesel and protein. ICABET 2016. International Conference on Advances in Bioprocess Engineering and Technology, Heritage Institute of Technology, Kolkata, India; January 20-22, 2016.
- Soumyajit Sen Gupta, Sharad Bhartiya, Yogendra Shastri. Optimized process synthesis of biodiesel production from microalgae. ICAER 2015. 5th International Conference on Advances in Energy Research, Department of Energy Sciences and Engineering, IIT Bombay, Mumbai, India; December 15-17, 2015.

Awards and Achievements

- ✓ Won the best speaker's award in the theme 'Process Systems Engineering' in Research Scholars' Symposium, Department of Chemical Engineering, IIT Bombay in 2015 and 2017
- ✓ Won the Institute silver medal for the academic year 2011-12 for being adjudged as the best student in order of merit among the graduating M.Tech. students of Department of Chemical Engineering, IIT Kharagpur

Organizational Activities

Core-team member and organizer of

- ✓ 'Research Scholars' Symposium', the departmental research scholars' confluence of Department of Chemical Engineering, IIT Bombay in 2014 and 2015
- ✓ IFAC (International Federation of Automatic Control) Conference - 12th International Symposium on Computer Applications in Biotechnology (CAB) and 10th International Symposium on Dynamics and Control of Process Systems (DYCOPS) at IIT Bombay in 2013
- ✓ 'CHEMBridge', the annual reunion program of Chemical Engineering Department, Jadavpur University in 2009 and 2010