

Dr. Chinta Sankar Rao

Assistant Professor

Systems and Control Research Laboratory

Department of Chemical Engineering

National Institute of Technology Karnataka, Surathkal

Email: csrao@gmail.com

Research Interest

Process Control, Model based control, Subspace Identification, Crystallization Engineering, Process Modelling and Simulation, Multivariable control, Wastewater Treatment

Academic Employment

May 2016 – present	Assistant Professor , Department of Chemical Engineering National Institute of Technology Karnataka, Surathkal
July 2015 – May 2016	Temporary Faculty , Department of Chemical Engineering National Institute of Technology Tiruchirappalli, Tamilnadu
July 2008 – May 2009	Ad-hoc Faculty , Department of Chemical Engineering Indira Gandhi Institute of Technology, Sarang, Odisha

Education

2011 – 2015	Doctor of Philosophy (Ph.D.) Indian Institute of Technology Madras , Chennai
2009 – 2011	Master of Technology (M.Tech.) Indian Institute of Technology Kharagpur , West Bengal
2004 – 2008	Bachelor of Technology (B.Tech.) Indira Gandhi Institute of Technology, Sarang , Odisha

Book(s) Published

M. Chidambaram and **C. Sankar Rao**, Subspace identification of dynamic systems, Narosa Publishing House, New Delhi, ISBN 978-81-8487-596-6.

Refereed Publications

1. **C. S. Rao** and K. Barik, Modelling, Simulation and Control of Middle Vessel Batch Distillation Column, *Procedia Engineering*, vol. 38, pp. 2383-2397, **2012**.
2. S. Mohanta, **C. S. Rao**, A. B. Daram, S. Chakraborty and B. C. Meicap, Air Dense Medium Fluidized Bed for Dry Beneficiation of Coal: Technological Challenges for Future, *Particulate Science and Technology*, 31: pp. 16-27, **2013**

3. **C. Sankar Rao** and M. Chidambaram. Subspace identification of transfer function models for an unstable bioreactor. *Chemical Engineering Communication*, 202(10), 1296-1303, **2015**
4. **C. Sankar Rao** and M. Chidambaram. Experimental application of subspace identification of an unstable system, *International Journal of Advances in Engineering Sciences and Applied Mathematics*, 7, 70-76, **2015**.
5. **C. Sankar Rao** and M. Chidambaram. Subspace Identification of Unstable Transfer Function Models, *Indian Chemical Engineer*, 57, 1-20, **2015**.
6. A. Sahoo, T. K. Radhakrishnan and **C. Sankar Rao**. Modeling and control of a real time shell and tube heat exchanger, *Resource-Efficient Technologies*, 3, 124-132, **2017**.
7. V. Dhanya Ram and **C. Sankar Rao**. Identification and Control of an Unstable SOPTD system with positive zero, *Computer Aided Chemical Engineering*, 44, 757-762, **2019**
8. Purushottam Patil and **C. Sankar Rao**, Enhanced PID Controller for Non-Minimum Phase Second Order Plus Time Delay System, *Chemical Product and Process Modeling*, 14 (3) (March, **2019**)
9. Prabhu Teja Y and **C. Sankar Rao**, Design of Robust PI Controller with Decoupler for a Fluid Catalytic Cracking Unit, acetylsalicylic acid, 58, 45, 20722-20733 (Oct, **2019**)
10. M. Satya Narayana, G. Arthanareeswaran and **C. Sankar Rao**, Dynamic performance comparison of two configurations of middle vessel batch distillation column for the separation of ethanol/propanol/butanol mixture, *Asia Pacific Journal of Chemical Engineering*, **2020**, DOI: <https://doi.org/10.1002/apj.2421>
11. Abhishek, Indraneel Pulidindi and **C. Sankar Rao**, Novel strategies for glucose production from biomass using heteropoly acid catalyst, *Renewable energy*, 159, 215-220, **2020**.
12. Sanjith S. Anchan and **C. Sankar Rao**, Robust Decentralized PID controller design for an Activated Sludge Process, *Asia Pacific Journal of Chemical Engineering*, **2020**, DOI: <https://doi.org/10.1002/apj.2531>
13. Gourav Yadav, G. Uday Kiran and **C. Sankar Rao**, Robust optimal centralized PI controller for a uid catalytic cracking Unit, *Chemical Product and Process Modeling*, **2020**, DOI: <https://doi.org/10.1515/cppm-2020-0019>

Under Review

1. Sanjith S. Anchan and **C. Sankar Rao**, Activated Sludge Wastewater Treatment Plant: State of the art, *Journal of Environmental Chemical Engineering*

Work in Progress

1. Solubility studies of acetylsalicylic acid (Aspirin) for different solvents and thermodynamic modelling.
2. Solubility and nucleation kinetics from metastable zone width of Acetylsalicylic Acid
3. Design of centralized PI controller for square and non-square systems
4. Multi-objective optimization of batch cooling crystallization for acetylsalicylic acid

Conference Presentations

1. **C. Sankar Rao** and K. Barik, Modeling, Simulation and Control of Middle Vessel Batch Distillation Column, ICMOC 2012, Noorul Islam College, Tamilnadu
2. **C. Sankar Rao** and M. Chidambaram. Subspace identification of unstable systems by MON4SID algorithm, 10th IFAC International Symposium on Dynamics and Control Process Systems, 2013, pp. 666-671, IIT Bombay. (Dec 18-20, 2013)
3. **C. Sankar Rao** and M. Chidambaram. Subspace Identification of Unstable Transfer Function Model for a Magnetic Levitation System, Third International Conference on Advances in Control and Optimization of Dynamical Systems, 2014, pp. 394-399, IIT Kanpur. (Mar 13-15, 2014)
4. **C. Sankar Rao** and M. Chidambaram. Experimental application of subspace identification of an unstable system, International Conference on Modelling and Computer Simulation, 2014, IIT Madras, 2014. (Dec, 8-9, 2014)
5. P. Nagarjuna Reddy and **C. S. Rao**. Modelling and Simulation of Batch Distillation Column, ICMOC 2014, Noorul Islam College, Tamilnadu.
6. A. Sahoo, T. K. Radhakrishnan and **C. S. Rao**. Real-time implementation of two PID tuning methods for temperature control of shell and tube heat exchanger, Technoscape 2016, VIT, Vellore. (20-21 Oct, 2016)
7. Yashas Mohan Kumar, Sai Dinesh B. and **C. Sankar Rao**. Simulation and control continuous crystallization process, IES 2017, Japan. (1-3 March, 2017)
8. Purushottam Patil and **C. Sankar Rao**, Design of PID controller for non-minimum phase system, Chemcon 2017, HIT, Haldia (27-30 Dec)
9. Vura Chaitanya and **C. Sankar Rao**, Modeling and Simulation of CO₂ Capture Using Alkanolamines, First International Conference on Energy and Environment: Global Challenges, NIT Calicut, 2018, (9-10, March)
10. Purushottam Patil, Prabhuteja Y. and **C. Sankar Rao**, Tuning of PID Controller for an Unstable Non-Minimum Phase SOPTD System, CHEMCON 2018, NIT Jalandhar (27-30, December)

11. Prabhuteja Y. and **C. Sankar Rao**, Optimal Control of Fluid Catalytic Cracking Process, CHEMCON 2018, NIT Jalandhar.
12. Abhishek, Indra Neel Pulidindi and **C. Sankar Rao**, Novel strategies for glucose production from switchgrass using solid acid catalysts, CHEMCON 2018, NIT Jalandhar.
13. Sanjith S. Anchan and **C. Sankar Rao**, Simulation and Control of a Biological Wastewater Treatment Process, International Conference on Civil Engineering Trends and Challenges for Sustainability (CTCS 2019), N.M.A.M.I.T., Nitte, Mangalore (May 23 – 24).
14. Abhishek, Indraneel Pulidindi, **C. Sankar Rao**, Supported hydropoly acid for the production of fermentable sugar from cellulosic biomass, International conference on multifunctional and hybrid composite materials for energy, environment and medical applications, NIT Trichy, 9-11 September, 2019.
15. Sanjith S. Anchan and **C. Sankar Rao**, Design of decoupler for wastewater treatment plant, CHEMCON 2019, IIT Delhi.
16. G. Uday Kiran and **C. Sankar Rao**, Tuning of centralized controller for industrial scale polymerization reactor, CHEMCON 2019, IIT Delhi
17. Gourav Yadav and **C. Sankar Rao**, Design of a centralized PI controller for a non-square system with application to reverse osmosis process, CHEMCON 2019, IIT Delhi

Invited Talks

1. Delivered a talk on “Subspace Identification Methods” in AICTE sponsored short-term course on Process Control at IIT Madras (15th to 19th Dec, 2014).
2. Delivered a guest lecture on Process design and development in Faculty development program at MSRIT, Bangalore on 21st Jan, 2017.
3. Delivered a research talk on Overview of subspace identification in National workshop on Trends in Process Control at IIT Madras in 22nd April, 2017.
4. Delivered a technical talk on Process Modelling and Simulation for Chemical Process in workshop on modelling and simulation of Engineering Systems at NIT Trichy during 23-24 March, 2018.
5. Delivered a technical talk on Chemical Process Modelling and Simulation using MATLAB in TEQIP-III sponsored National workshop Course on “Application of Chemical Engineering in Natural Resources (AChENRI)” during 17-21, July, 2018 at IGIT Sarang.
6. Delivered a technical talk on Process Modelling and Simulation using DWSIM and MATLAB in TEQIP-III sponsored National workshop Course on “Modelling, Simulation and Data analysis for experimental research MSDAER-2019” during 28th Jan -2nd Feb, 2019, 2018 at VSSUT, Burla.

- Delivered a keynote lecture on subspace identification of unstable systems for control in the International Conference on Advances in Systems, Control and Computing (AISCC 2020) at MNIT Jaipur during 27-28, Feb 2020

Workshops/Seminars

- Coordinated and conducted a Scilab Workshop on 10th April, 2013 at IIT Madras.
- Attended the two days' workshop on "Model Predictive Control" conducted by Dr. John Bagterp Jørgensen of the department of Applied Mathematics & Computer Science, Technical University of Denmark.
- Coordinated and conducted "Aspen Plus Workshop" on 3rd July, 2015 at Shaastra 2015, IIT Madras
- Coordinated and conducted Aspen plus and Aspen Dynamics workshop on 14th March, 2015 at ChemClave 2015, IIT Madras.
- Attended 1st Indian Control Conference 2015 at IIT Madras during 5-7 Jan, 2015
- Attended the workshop on Symbolic Computing and Numerical Programming using Mathematica/Matlab (SCNPMM) during 10th – 12th July, 2015 at NIT Warangal
- Attended the workshop on Industrial Automation (IA-2015) from 17th to 19th August, 2015 at NIT Tiruchirappalli
- Attended the workshop on Advanced Process Control (ACE 2015) from 9th to 10th Oct, 2015 at NIT Trichirappalli
- Participated in three day workshop on Parallel Computing with GPUs conducted by GPU Centre of Excellence (GCOE), IIT Bombay organized by National Institute of Technology, Trichy. (Mar 8-10, 2016).

Guidance

On-going	Ph.D.	Sanjith S. Anchan	Optimization and control studies on activated sludge process
2020	M.Tech. (Research)	Abhishek Nayak	Novel strategies for glucose production from biomass using heteropoly acid catalyst
2018	M.Tech	Purushottam S. Patel	Design of PID Controller for non-minimum phase systems
2018	M.Tech.	Vura Chaitanya	Modeling and Simulation of CO ₂ capture using Alkanolamines
2018	M.Tech.	Mohd. Fayaz	Development of a Novel Technique to Probe Self-Assembly of Asphaltene Molecules
2019	M.Tech.	Prabhuteja Yendmuri	Design of Controller for Multivariable Processes
2020	M.Tech.	Gundla Uday Kiran	Solubility and Nucleation kinetics of Acetylsalicylic Acid: Experiments and

2020	M.Tech.	Gourav Yadav	Modelling Design of Centralized PI Controller for a Multivariable Process
On-going	M.Tech	Sonu Jain	Optimization studies on batch cooling crystallization
On-going	M.Tech.	G. Prabhu Mani Teja	Model predictive control of batch crystallization
On-going	M.Tech.	Bhandari Kumar	Shiva Design controllers for multivariable processes

UG Student Supervision

2017	Sai dinesh Yashas Mohan Nikshep Trinetra	Design of P/PI controller for the parallel cascade systems for critically damped second order system.	Completed
2018	Anish Roy Rohan Adhikari Sridhar Eaishwary Ashok Kamble	Multiobjective optimization for tuning P/PI controller for cascade control systems	Completed
2019	Prabhjot Kaur Luthra Avanika B.R. Prabhul Pradeep Kumar	Identification and Control Studies of Multivariable Process with Application to Fluid Catalytic Cracking Process	Completed
2020	Varsha Mavath Tharfeed Ahmed Unus Adarsh S. Nair	Control and optimization studies on batch cooling crystallization	Completed
present	Bharat Desikan Pranav Krishna Suveer Avantsa	Control studies on middle vessel batch distillation column	On-going

Roles and Responsibilities

2020 – 21	Faculty Advisor, B.Tech II Year (2019 Batch)
2017 – 18	Faculty Advisor, B.Tech. II Year (2016 Batch)
2018 - 19	Faculty Advisor, B.Tech. III Year (2016 Batch)
2018 - 19	Faculty Advisor, B.Tech. III Year (2016 Batch)
2018 – 19	DUGC Secretary of the department
2017 – present	Department IRIS (MIS) Coordinator
2017 – present	Department Time Table Coordinator

Editorial Board Member

1. International Journal of Chemical Engineering and Processing
2. International Journal of Chemical Synthesis and Chemical Reactions
3. International journal of Thermodynamics and Chemical Kinetics

Reviewer for International Journals

1. ISA Transactions
2. Chemical Engineering Communications
3. Industrial and Engineering Chemistry Research
4. Conference on Control Technology and Applications
5. Process Systems Engineering
6. Chemical Product and Process Modelling
7. European Control Conference (ECC)
8. Asian Journal of Chemical Engineering