



Professor & Group Leader: Control Systems.
Young Scientist Scheme Grant Awardee (2013-2017), DST. G.O.I.
Co-PI, ISRO Research Project, G.O.I(2019-2021)
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Dr.I.Thirunavukkarasu, Ph.D. IEEE Senior Member

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Pure Elsevier : <https://manipal.pure.elsevier.com/en/persons/thirunavukkarasu-indiran>

Désignation :

Professor

Additional Professor
Associate Professor- Senior Scale
Associate Professor
Assistant Professor-Sr. Scale
Lecturer, ICE, MIT, Manipal
Lecturer, EIE, Hindustan College of Engg.
Lecturer, EEE, Thirumalai Engg. College

- 23rd Feb. 2023 onwards

- 1st Jan 2023 to 22nd Feb. 2023 (1.2 Months)
-12th July 2017 to 31st Dec 2022 (5. 5 yrs)
-2nd April 2012 to 11th July 2017 (5.3 yrs)
-7th April 2009 to 1st April 2012 (3 yrs)
- 15th July 2006 to 6th April 2009 (2. 9 yrs)
-August 2005 to 13th July 2006 (11 Months)
- Feb. 2005 to August 2005 (6 Months)

Post Doctoral Research (Oct 2020- March 2021) to work on Parameter Estimation and Non-linear controller design under **Prof.Dr.Radhakant Padhi**, Dept. of Aerospace, **IISc, Bangalore.**

Visiting Professor (2018), Dept. of Chemical Engineering, Ryerson University, Canada

Research Collaboration (Dec. 2021): Prof. Prashant Mhaskar, McMaster University, Canada.

Teaching Expérience : 19Yrs.

Area of Research : NMPC, NMBC, T-MPSP, State Estimation and Non-linear Kalman filters.

Alma Mater :

Post Doctoral Research & Publication

- M.I.T, MAHE, India. 2013-2015.

Ph.D (Control Systems)

– M.I.T, MAHE, India - 2012.

M.E (Process Control & Instrumentation)

– 1st Class, Annamalai University, India - 2005.

B.E (Instrumentation & Control Engg.)

– 1st Class, Madras University, India - 2002.

Diploma (ECE)

– 1st Class with Honors.

State Board of Technical Education, 1999

Marital Status: Happily Married; have two children.

Skill Sets: MATLAB, MAPLE, PID Algorithms, Implementation of Control algorithms on Pilot Plants,

Area of Specialization: Advanced Process Control, Control Systems, Robust & Optimal Control.

Post-Doctoral : Design and Implementation of a Sliding Mode Controller for the Nonlinear process

Doctoral Thesis: Optimal Robust H-Infinity Controller for an Integrating Process with Dead Time,

Doctoral Thesis Advisor: Prof.(Dr.) V.I.George,

Thesis Examiner: Prof.(Dr.) J.Prakash, IE, MIT, Anna University.

Master's Thesis: Fault Identification and Accommodation in a Three Tank System.

Thesis Advisor: Prof.(Dr.) S.Abraham Lincon

Thesis Examiner: Prof.(Dr.) S.Sundara Moorthy, Chemical Engg. PEC,
Puducherry.

Under Graduate Thesis: Design and Development of the PLC program for the CSRDM
carried out in IGCAR, Kalpakkam. Dept. of Atomic Energy, Govt. of India.

Thesis Advisor: Sri.P.Udhaya Kumar, Scientist, MAPS, Kalpakkam. /

Sri.S.Chandrasekhar, Scientist, IGCAR, Kalpakkam

Examiner: Prof. Umashankar, Ex-Professor & Head-EEE, MIT, Manipal

Professional Memberships

IEEE Senior Member

- 94463159

Life Member in Systems Society of India

- LM27072

Life Member in Indian Society of Technical Education

- LM55395

Associate Member in Institution of Engineers-India

-AM09652907

Life Member in ISSE, India.

-LM 00275

American Chemical Society Member

- 31981804

ACDOS Member (Indian National Member Organization of IFAC) - Professional member till 31/12/2023

Subjects Taught.

For UG

Virtual Instrumentation, Optimal Robust Control, Sensor Signal Processing, Process Instrumentation & Control, Digital Signal Processing, Analog System Design, Electronic Instrumentation, Neural Networks and Fuzzy Logic, Industrial Instrumentation – I, Industrial Instrumentation – II, Instrumentation & Transducer, Network Analysis and Synthesis, Dynamics of Systems, Control Systems, Modern Control Theory, Instrumentation and Control in Petrochemical Industry, Chemical Process Systems, Linear Control Theory, Robust Control.

For PG (10+ Year's Experience)

Process Dynamics and Control, Advanced H-Infinity Control, Optimal Control, Nonlinear Control Systems, System Modeling and Identification, Advance Virtual Instrumentation, Soft Computing, Robotics and Automation, Space Science Instrumentation, Space Mission Analysis and Design Technique.

Ph.D Thesis Evaluated as Indian Examiner. [Interaction with outside world]

- 1.“A Noval Maximum Power Point Tracking of Photovoltaic Array and Online Dynamically Coupled Control of Micro-Grid Connected Inverter” - Anna University, Chennai, 2014.
- 2.“Fuzzy Logic Based Super-Twisting Sliding Mode Controllers for Dynamic Uncertain Systems “, St. Peter’s University, Chennai, 2014.
- 3.“Certain Investigations on Control Strategies for Linear and Non-Linear Systems”, Annamalai University, Chidambaram, 2015.
- 4.“Comprehensive Analysis of Intelligent Controllers for LFC Applications”, Annamalai University, Chidambaram, 2016.
- 5.“Certain Investigation on Tuning Of PID Controller In Automatic Voltage Regulator System By Bio-Inspired Optimization Techniques”, Anna University, Chennai, 2016.
- 6.“Development of Optimal Controller for Parallel Operation and Interconnected Operation of Heavy Duty Gas Turbine Plants”, Anna University, Chennai, 2016.
- 7.“Certain Investigation on tuning of PID controller in Automatic Voltage Regulator System by Bio-Inspired Optimization Techniques”, Anna University, Chennai, 2016.
- 8.“Application of Computational Intelligent Technique for Load-Frequency Control of Interconnected Power System”, Annamalai University, Chidambaram, 2016.
- 9.“Performance Enhancement of a Boiler using Flame Image Processing”, Annamalai University, Chidambaram, 2016.
10. “Development of Optimal Controller for Parallel Operation and Interconnected Operation of Heavy Duty Gas Turbine Plants”, Anna University, Chennai -2016.
11. “Design of Economic Dispatch and Economic Emission Dispatch Models for GENCOS with Thermal and Wind Powered Generators”, Anna University, Chennai -2016.
12. “Automatic Blood Gases Control in Perfusion System for ECMO Support and CPB surgery Conditions”, Annamalai University, Chidambaram-2016.
13. “Investigation in Location based Multipath Secured Energy Efficient Routing Approach for MANET”, Karpagam University, Coimbatore-2016.

14. "Design and Analysis of Two Degree of Freedom Hybrid Controller for Integral Process with Longer Time Delay", Anna University, Chennai - 2017.
15. "Certain Investigations on Soft Computing Techniques based Controllers for Bidirectional DC-DC Converters", Karunya University(Deemed), Coimbatore-2017.
16. "Certain Investigations on The Performance and Comparative Analysis of Three Phase Induction Motor with ANN Controller", Anna University, 2018.
17. "Implementation of Maximum Power Point Tracking Controller for PMSG Based Variable Speed Wind Energy Conversion System", Anna University, 2018.
18. "Certain Investigation on Segmentation of Image and Video for Multiple Object Detection", Annamalai University, 2020.
19. "Design of Soft Computing Controller for Direct Torque Control Induction Motor Drive", Anna University, 2020.
20. "A Novel DLIONABC Segmentation and Feature Selection Approach for Lung Cancer Recognition on CT Images Based On ICNN Classification", SRM University (Deemed), 2020.
21. "A certain investigation on effluent waste water treatment process", Karunya University(Deemed), 2020.
22. "Wireless Sensor Network (WSN) Based Analysis of Healthcare and Movement Parameters For Horizontal Distance Event – Javelin", Tamil Nadu Physical Education and Sports University", 2021.
23. "Investigation of Multilevel Inverters for Photovoltaic System", Sri Chandrashekara Saraswathi Swamigal Viswa Maha Vidyalaya, Enathur, Kanchipuram, 2021.
24. "Design, Development and Fabrication of PdIrCo Coated On SnO₂ Thin Films As Ultra-Sensitive NO₂ Gas Sensors", SRM University (Deemed), 2022.
25. "Certain Investigations on Design and Analysis of Loop Shaping Controller for Nonlinear Multivariable System with Control Challenges using Optimization Technique", Anna University, 2022.
26. "Power Quality Improvement of Multibus Systems Using Shunt Active Filter", SCSVMV Deemed University(Deemed), Kanchipuram, 2022.
27. "Modeling and Analysis of Nonlinear Multivariable Process using Soft Computing Techniques", Sathyabhama University (Deemed), Chennai, 2022.
28. "Design of Integrated Robotic Control Systems and Evaluation Of Drilling Temperature Effects For Dental Implantation Procedures", SRM University(Deemed), 2022.
29. "Hybridization of Modified Social Spider with Krill Herd Optimization for energy aware data aggregation techniques in wireless sensor networks" PRIST University (Deemed), Thanjore.

Academic Audit Coordinator:

- 1.Academic audit for B. Tech(ICE), 2017 – Expert Prof. M. Chidambaram, NIT W.
- 2.Academic audit for M. Tech(CS), 2021 – Expert Prof. Ravindra D Gudi, IIT B.
- 3.Academic audit for B. Tech(EIE), 2021 – Expert Prof. Prakash. J, MIT, Anna University.

Universities Visited on Abroad

- 1.Universiti Teknologi of MARA, Pulu Pinang, Malaysia- Dec 2008.
- 2.Nanyang Technological University, Singapore- Feb 2010.
- 3.Sultan Qaboos University, Muscat-Oman – Dec 2010.
- 4.Ryerson University, Toronto, Canada – Aug 2013.
- 5.University of Westminster, London-UK – June 2014.
- 6.Manipal University Dubai, Dubai – Oct. 2014.
- 7.Saarbrücken University, Germany – June 2015.
- 8.University of Palermo, Italy – Nov. 2015.
- 9.Chulalongkorn University, Thailand – June 2016.
10. Massachusetts Institute of Technology, Boston – Sep. 2016.
11. King Mongkut's Institute of Technology Ladkrabang, Thailand. – Oct. 2017.
12. University of Malaya, Kuala Lumpur, Malaysia – Nov. 2017
13. University of Bahrain, Bahrain – April 2019.
14. Amity University, London – April 2019.

Lab Established: *Advanced Process Control Lab* for PG Control Systems in ICE Dept.

Awards

- 1.Research Incentive cash award from Manipal University for the research publication in 2008.
- 2.Received the best paper award in CISCON'08.
- 3.Received Conference grants from Manipal University to present the research paper in Malaysia, Oman Conferences
- 4.Received the best paper award in ICM2ST-2011 International Conference, Jaipur, Nov. 2011.
- 5.Received the best paper award in DRDO-CSIR Sponsored 9th CISCON-2012.
- 6.Under the “Excellence in Teaching and Research publication” of Manipal University scheme availed the round trip facility to Ryerson University, Toronto, Canada for the ICMEM'13 conference.
- 7.Awarded Rs.5,000/- as 1st Price in Paper presentation(Best paper award) in Manipal Research Colloquium- Apr. 2014.
- 8.Best Paper award in ICDAMS, Saveetha University, Chennai. 7th-8th April 2016.
- 9.Best Paper award in ICPEME-2016, Bangkok, Thailand, 18th-19th June 2016.
10. Best Paper award in FAME-2016, Sathyabama University, 18th-9th July 2016.
11. Best Paper award in ICICE-2016, Chicago, USA, 19th Sep. 2016.

12. Best Paper award in ICRIET-2016, Orissa, 5th-6th Nov. 2016.
13. Best Paper award in IEEE- ICPCT, Kollam, Kerala – 20th-21st April 2017.
14. Best Paper award in ICEEC-2017, Pune on 20th March 2017.
15. Best Paper award in Cambridge Summit-2018, London- Jan 2018.
16. Best Paper award in ETMN-2021, MUJ, Jaipur, 8-9 Oct 2021.

Grants/Funding Received

S. No	Funding Agency	Event	Amount
1	DRDO, Govt. of India	International Conference ICSDC2010	Rs.35,000/-
2	ISRO, Govt. of India	International Conference ICSDC2010	Rs.50,000/-
3	National Instruments, Bangalore	International Conference ICSDC2010	Rs.50,000/-
4	MRPL (Subsidy of ONGC, Govt. of India), Mangalore.	International Conference ICSDC2010	Rs.10,000/-
5	Edu. Tech (I) Ltd, Chennai.	International Conference ICSDC2010	Rs.25,000/-
6	DRDO, Govt. of India	CISCON2011 – An International Conference	Rs.35,000/-
7	MIT, MAHE, Manipal	Post-Doctoral Research Grant	Rs.1,20,000/- (Completed)
8	DST-Fast Track Young Scientist Scheme Ref. No: SERC/ET-0308/2012	Project worth of Rs.13.53 Lakhs	Rs.13.53 Lakhs Sanctioned for 3 years. Completed with Excellent Grade in meeting held in IIT-Madras, Apr'17.
9	BRNS, DAE, Govt. of India. Ref. No: 2012/17/34/101/140-BRNS/2420	FDP on Process Control 17 th -21 st Dec '13.	<u>Rs.50,000/-</u>
10	Design of SMC for Quadrotor UAV. ISRO, Govt. of India.	Rs.12.28 Lakh	<u>On-Going</u>

11	Research Seed Money Grant, MAHE Manipal towards “Kinetic modeling of Batch Reactor and implementation of nonlinear control algorithm”	Rs.50,000	Completed with three Q2 Publications.
12	ISRO, Govt. of India (Nonlinear Controller implementation on MAV)	Rs.19.5 Lakh	<u>Under Review.</u>
13	Industry Sponsored Research on Batch Reactor	Rs. 4,00,000	<u>On-Going</u>

University Assignments:

1. Question paper setter for (a) Anna University, Chennai. (b) Goa University, Goa (c) Kannur University, Kannur (d) Kongu Engg. College (Autonomous), Perundurai, Erode. (e) CVR College of Engg., Hyderabad
2. Served as an observer for the SMU distance education exam in Hyderabad center.
3. Indian Examiner for Ph.D Thesis Evaluation – Anna Univ., Annamalai University, SRM Deemed University, Sathyabhama Deemed University, SCSVMV Deemed University, Karunya Deemed University.
4. External Member for B.O.S-Sri Ramakrishna College of Engg., Coimbatore-2016.
5. DCC Member, EIE Dept., Sri Ramakrishna College of Engg., Coimbatore-2019.
6. Question paper setter & Moderator for EIE, Ramaiah Institute of Technology, Bangalore, 2021
7. B.O.S External member for EIE Dept, Ramaiah Institute of Technology (Autonomous) , Bangalore, 2022.
8. B.O.S External member for EE Dept, ADAMAS University, Kolkata, West Bengal, 2022.

Guest Editor:

1. International Journal of Intelligent Systems Technologies and Applications, Vol. 19, No.4, 2020, Inderscience Publication. ISSN: 1740-8873(Online) & 1740 8865 (Print)
2. International Journal of Vehicle Information and Communication Systems, Vol.6, No.1, 2021 , Inderscience Publication. ISSN: 1741-8208(Online) & 1741 0242 (Print)

Editor, Reviewer (Peer Reviewed SCI Journals) & MoU :

1. Proceedings of International Conference on System Dynamics and Control (ICSDC 2010). *I.K International publishing house Pvt. Ltd. ISBN 978-93-80578-58-3* (<http://eprints.manipal.edu/id/eprint/142464>)
2. ISA Transactions (Q1) – Reviewer.
3. Industrial and Engineering Chemistry Research (Q1) – Reviewer.

4. ACS Omega (Q2) – Reviewer.
5. Inderscience Publications- Reviewer.
6. Doctoral Committee Member (Area: Advanced Process Control), Karunya Institute of Technology and Science, Coimbatore.
7. MoU with Prof. Srinivas Palanki, Chemical Engineering, West Virginia University – Students /Faculty Exchange – Jan 2022 to Jan 2027.
8. Research – Funding (Pvt. & Govt.) Collaboration with MUJ, Jaipur in the area of Advanced Process Control.
9. Research Collaboration with Faculty of Engineering, Naresuan University, Thailand.

B.Tech Honors Students Mentorship.

1. Vignesh Renganathan, “Design and Implementation of MPSP on a Binary Distillation Column Pilot Plant”, 2021-2023. (One and half years’ project)
2. Gautham Raj, “Validation of UKF-NMPC on a laboratory scale Binary Distillation Column”, 2021-2023. (One and half years’ project)

Journal Publications:

2022:

1. Prajwal Shettigar J, Eadala Sarath Yadav, Jatin K, **Thirunavukkarasu Indiran** *et al* “Weiner Neural Network based modeling and Validation of GPC on Laboratory Scale Batch Reactor”, *ACS Omega (Q2, 3.91 Impact Factor)* 2022, 7, 19, 16341-16351. <https://doi.org/10.1021/acsomega.1c07149>
2. Suraj Suresh Kumar, **Thirunavukkarasu Indiran**, George Vadakkekara Itty, “Development of a Nonlinear Model Predictive Control-Based Nonlinear Three-Mode Controller for a Nonlinear System”, *ACS Omega (Q2, 4.13 ImpactFactor)*, Nov 2022. <https://doi.org/10.1021/acsomega.2c05542>
3. Sonu. N, **I. Thirunavukkarasu**, Shreesha. C, “Simulation Studies on Nonlinear Model Predictive Controller for Hexsoon Edu 450 Quadrotor for Trajectory Tracking”, IEEE International Conference on Sustainable Computing and Data Communication Systems” held during 7th-9th April 2022. IEEE Explorer: DOI: 10.1109/ICSCDS53736.2022.9760984.
4. Suraj Suresh Kumar, **Thirunavukkarasu Indiran**, George Vadakkekara Itty, “Simulation of Nonlinear Proportional Integral Derivative Controller for a Nonlinear Model of a HexSoon EDU 450 Quadrotor Aerial Robot”. IEEE Explorer, August 2022, DOI: 10.1109/ICICICT54557.2022.9917674
5. Tinu Valsa Paul, **Thirunavukkarasu Indiran**, George Vadakkekara Itty, Suraj Suresh Kumar and Chirag Gupta, “State of The Art Sliding Mode Controller For Quadrotor Trajectory Tracking”, International Conference on Robotics, Control, Automation and Artificial Intelligence, 24th-25th Nov. 2022, MIT, Manipal.
6. Suraj Suresh Kumar, Sonu.N **I. Thirunavukkarasu**, V. I. George, Radhakant Padhi, “Parameter Identification and Design of Nonlinear Model Predictive Controller for a Quadrotor UAV”, IFAC-World Congress, Japan-2023. – Paper ID: 1963 – Submitted.
7. Tinu Valsa Paul, **I. Thirunavukkarasu**, V. I. George, “Robust Homogeneous Sliding Mode Controller for Hexsoon EDU 450 Quadrotor with Stability Analysis”, Manuscript No.:2022-07-G007156 – Under Review.
8. Prajwal Shettigar.J, **Thirunavukkarasu Indiran**, Radhakant Padhi, “Efficiency and Robustness Enhancement of Chemical Batch Reactors using T-MPSP based Fast MPC” – Draft ready

9. Vinayambika S Bhat, Shanmugapriya S, **Thirunavukkarasu Indiran**, Shreeranga Bhat, “Designing Multivariable PI Controller with Multi-Response Optimization for a pilot plant binary distillation column: A Robust Design Approach”, (JEDT-12-2022-0616)- Under review.
10. Prajwal Shettigar J, Cyril Joseph, Bredon D’Souza, Akshay K, **Thirunavukkarasu Indiran et al** “Estimation of Heat Release in Batch Reactor using Neural Networks and Validation of GMC for a Polymerization Process”– **Under Review**
11. Prajwal Shettigar J, Harishankar, **Thirunavukkarasu Indiran**, “Support Vector Machine based Modeling and Validation of Nonlinear GPC control for a Batch Reactor Pilot Plant”- Draft ready - **I&ECR (Q1)**
12. Krupa Narwekar, Prajwal Shettigar.J, **Thirunavukkarasu Indiran**, “Design and Validation of class of Sliding Mode Controllers for a Polymerization Reactor in the presence of Parameter Uncertainty” – Writing in Progress.
13. Pavanraj.H.R, Prajwal Shettigar.J, **Thirunavukkarasu Indiran**, “Implementation of Receding-Horizon Nonlinear Kalman Filter based NMPC for an Acrylamide Polymerization Batch Reactor” – In Progress.
14. Prajwal Shettigar.J, **Thirunavukkarasu Indiran**, Radhakant Padhi, “Neuro Adaptive Controller based on RBF for a Lab Scale Batch Reactor” – In Progress.

2021

1. Salikandi, M., Ranjbar, B., Shirkhan, E., S.Shanmuga Priya, **Thirunavukkarasu, I.**, Sudhakar, K, “Recent trends in liquid desiccant materials and cooling systems: Application, performance and regeneration characteristics”, Journal of Building Engineering (Q1), **Impact Factor: 3.379**, 2021, 33, 101579
2. Tinu Valsa Paul, V.I.George, **Thirunavukkarasu Indiran**, “Nonlinear Dynamic Modeling of a Quadrotor and its Control using SMC” – **Journal of Aerospace Engineering (Q2) Impact Factor: 1.78** –**Accepted- ASENG-3722R2 (Final revisions submitted)**
3. Eadala Sarath Yadav, Prajwal.J, Susmitha Poojary, Shreesha.C, **Thirunavukkarasu Indiran**, “Data Driven Modeling of Pilot Plant Batch Reactor and Validation of Nonlinear Model Predictive Controller for a Dynamic Temperature Profile Tracking”, **Manuscript ID: ao-2021-000878, ACS Omega (Q2), Impact Factor 2.87. D.O.I: 10.1021/acsomega.1c00087, June 2021**
4. Mary Ann George, Dattaguru V. Kamath, **Thirunavukkarasu Indiran**, “OTA-C realization of an optimized PI^λD^μ controller for BLDC motor speed control”, **IETE Journal of Research (Q3)**, P.No.1-19, July 2021, **Impact Factor: 1.03, D.O.I: <https://doi.org/10.1080/03772063.2021.1951380>**
5. Prajwal Shettigar J, *et al.* “Validation of Advanced Nonlinear Predictive Control Algorithms on a Lab-Scale Acrylamide Polymerization Batch Reactor”, ACS Omega (Q2), **Impact Factor: 3.512, (<https://doi.org/10.1021/acsomega.1c03386>), August 2021.**
6. Janani.R, Eadala Sarath Yadav **Thirunavukkarasu Indiran**, “Experimental Modeling and Validation of Control Algorithms on a Lab Scale Non-Square Batch Distillation Column” – **RANE-2022-Under Review.**
7. S.Meenatchi Sundaram, Navya Sree Shetty, Hariharan, **Thirunavukkarasu Indiran**, “Batch Reactor Temperature Control using Optimized DMC based PID” – **RANE-2022-Under Review.**

8. Abhirami.M, **Thirunavukkarasu Indiran** “Maximum Sensitivity based PID Controller for active load disturbance rejection in Lab Scale Batch Reactor-An Experimental Work”- CISCON-2021– *SpringerLecture Series – Under Process.*
9. Sandipan Kumar Mishra, Sarath Yadav.E. **Thirunavukkarasu Indiran**, “Validation of Split Range Control Algorithm on a Laboratory Scale Batch Reactor Heating System” – *Best Paper Awarded*, MUJ, Jaipur. 9th Oct 2021. *AIP Proceedings*

2020

1. Yadav, Eadala Sarath, **Indiran, Thirunavukkarasu**, Priya, S Shanmuga, “System Identification and Conditional Control for an Optimal Operation of a Pilot Plant Binary Distillation Column” International Journal of Computing and Digital Systems, Issue:1, Vol.9,2020.
2. Eadala Sarath Yadav, **Thirunavukkarasu Indiran**, S. Shanmuga Priya, “Optimal Energy Consumption of Distillation Process and its Purity Analysis Using UV Spectroscopy” ACS Omega, Vol.6, Issue 2, P.No: 1697-1708. *Published on 31/12/2020* [<https://pubs.acs.org/doi/pdf/10.1021/acsomega.0c0573>] [[ScopusQ2/WOS-Impact Factor : 2.87](#)]
3. Janani.R, Vinayambika.S.Bhat, **Indiran Thirunavukkarasu**, V.I.George, “Identifying the Stabilizing region of PI Controller based on Frequency Specifications for a Lab Scale Distillation Column”, International Journal of Digital Signals and Smart Systems, Vol.4, No.1/2/3, 2020, [Inderscience Publishers.](#)
4. Eadala Sarath Yadav, **Thirunavukkarasu Indiran**, Dayananda Nayak, “Simulation Study of Distillation Process using ASPEN Plus” – *Materials Science Today Proceedings*, Available online from 4 September 2020.
5. Suraj.S, V.I.George, **Thirunavukkarasu Indiran**, “Sliding Mode based Control Design for a Quadrotor UAV”, *CISCON-2020, Springer Lecture Series. –Presented.*
6. Janani.R, **Thirunavukkarasu Indiran**, “Decentralized PI Controller Tuning Based on Routh Hurwitz Tuning for an Interacting Distillation Process”. Presented in an International Conference. Dept. of Mechanical Engg, Serbia. Nov, 2020.
7. Janani.R, **Thirunavukkarasu Indiran**, Sarath Yadav.E, S. Shanmuga Priya, “Modeling and Control of Tray Temperature along with Column Pressure in a Pilot Plant Distillation Column”, Extended paper of ICACTM2019 in the Special Issue on Computational Statistics, [Springer Nature Journal](#), Oct. 2020.

2019

1. Eadala Sarath Yadav, **Thirunavukkarasu Indiran**, S.Shanmuga Priya and Giuseppe Fedele., “Parameter Estimation and Extended Predictive Based Tuning Method for a Lab Scale Distillation Column”, [ACS Omega, ACS Publications, Dec. 2019 \[ScopusQ1/WOS-IF: 2.58\]](#)
2. Eadala Sarath Yadav and **Thirunavukkarasu Indiran** et al., "PRBS based model identification and GPC PID control design for MIMO Process", [Materials Today: Proceedings, Elsevier Publications](#), Volume 17, Part 1, 2019, Pages 16-25 [Scopus Indexed].
3. Yadav, Eadala Sarath; **Indiran, Thirunavukkarasu**; Priya, S Shanmuga, “Experimental Validation of Amigo Based PID for a Binary Distillation Column” International Journal of Engineering and Advanced Technology, Volume-9, Issue-1S3, December 2019

2018

1. Vinayambika S Bhat, **I. Thirunavukkarasu**, S. Shanmuga Priya, “Design of Centralized Robust PI Controller for a Multivariable Process”, **Journal of Engineering, Science and Technology**, vol. 13, no. 5, pp. 1253-1273, 2018. ISSN: 1823-4690 (SCOPUS Indexed). 2018.
2. EdalaSarathYadhav, **Dr.I.Thirunavukkarasu**, S. Shanmuga Priya, Relay Based Identification and Control of SISO process –An Experimental Approach via Conical Tank, *International Journal of Pure and Applied Mathematics*, 118 (20). ISSN 1314-3395
3. Vinayambika S. Bhat, **I. Thirunavukkarasu**, S. Shanmuga Priya, Janani.R “Identifying the Stabilizing Region of PID Controller Using Polytopic Polynomial Approach for Pilot Plant Binary Distillation Column” vol. 118, no. 18, pp. 2229-2240, 2018. ISSN 1311-8080.
4. Janani.R, **I. Thirunavukkarasu**, Vinayambika S Bhat, “Experimental implementation of CDM based two mode controller for an interacting 2*2 distillation process” vol. 118, no. 18, pp. 2241-2251, 2018. ISSN 1311-8080.
5. Santhosh Kumar. P. L,S. Selva Kumar, **I. Thirunavukkarasu**, Vinayambika S. Bhat, “Decentralized PI controller with decoupler for the distillation column”, *International Journal of Pure and Applied Mathematics*, vol. 118, no. 20, pp. 9-14, 2018. ISSN 1311-8080.
6. Santhosh Kumar. P. L,S. Selva Kumar, **I. Thirunavukkarasu**, Vinayambika S. Bhat, “Experimental validation of PI controller based on pole placement for a batch distillation column”, *IJPAM*, Vol. 118, no. 9, pp. 413-419, 2018. ISSN 1311-8080
7. Santhosh Kumar. P. L,S. Selva Kumar, **I. Thirunavukkarasu**, Vinayambika S. Bhat, “Smith Predictor Based PI Controller Design for a Batch Distillation Column” , *IJPAM*, vol. 118, no. 22, pp. 1109-1115, 2018. ISSN 1311-808
8. Eadala Sarath Yadav, **Thirunavukkarasu Indiran**, Ganesh UG, Shreesha C, Akhil V Jose, “Online Relay Based System Identification and Controller design with Anti-Reset Windup for the Binary Distillation Column”, *International Journal of Engineering & Technology* 7(4):516-520, DOI: [10.14419/ijet.v7i4.30.25772](https://doi.org/10.14419/ijet.v7i4.30.25772)
9. T.Bhuvanendhiran, Abraham Lincon, I.Thirunavukkarasu & Edala Sarath Yadav, “Nonlinear Control Design For A Nonlinear Process- An Experimental Approach”, *Journal of Advanced Research in Dynamical and Control Systems*, 2018.
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33. Ashutha,K, Sarath Yadhav, **I.Thirunavukkarasu**, “AMIGO based PID control design for Non-linear process” in International Conference on Communication, Electrical, Electronics and Computer Engineering (ICEEC-2017) on 20th March 2017, Best Paper Awarded.
34. Janani. R , Vinayambika. S. Bhat , **I. Thirunavukkarasu**, S.Shanmuga Priya, “Design of H-infinity Loop Shaping PI Controller for a Distillation Column Model with an Experimental Validation”, Presented in IEEE conference held at Vimal Jothi College of Engg, Kottayam, Kerala, April 2018.
35. Eadala Sarath Yadav and **Thirunavukkarasu Indiran** et al., “PRBS based model identification and GPC PID control design for MIMO Process” *ICAMEES-2018*, Dec’18 UPES, Dehradun. (*Elsevier Proceedia–Scopus Indexed*)
36. Eadala Sarath Yadav and **Thirunavukkarasu Indiran** “PRBS Based Identification and Conditional Control for an Optimal Operation of a Pilot Plant Binary Distillation Column” *The 8th International Conference on Modeling, Simulation and Applied Optimization (ICMSAO’2019)*, Bahrain April 2019
37. Janani Rajaraman, Eadala Sarath Yadav and **Thirunavukkarasu Indiran**., “Modeling and Control of Tray Temperature along with Column Pressure in a Pilot Plant Distillation Column” *ICACTM - 2019*, AMITY University, London, UK- *IEEE Explorer (Scopus & Web of Science)*, April 2019.

ORGANIZER:

1. Resource person in five day work shop on “Process Control and Its Applications” in Department of Electronic and Instrumentation Engg, HCE, Chennai from 13-03-2006 to 17-03-2006
2. Organizing member of the Control and Instrumentation System National Conference CISCON06 – 3rd & 4th NOV 2006 - Manipal Institute of Technology – Manipal.
3. Co-Convener for the “Two day workshop on Digital Controls” - 9th & 10th FEB 2007 – M.I.T –Manipal.

4. Organizing member of the “National System Conference-2007” held in M.I.T-Manipal- 16th -18th Dec 2007.
5. Editor of the Control and Instrumentation System National Conference CISCON07 – 9th & 10th NOV 2007 - Manipal Institute of Technology – Manipal.
6. Co-Convener for the SDP on Modern Controller Design Techniques, 9th -13th June 2008.
7. Convener for the International Conference on System Dynamics and Control, 19th -22st August 2010, Manipal Institute of Technology – Manipal.
8. Convener for the **DRDO sponsored** 8th Control Instrumentation System Conference held during 3rd-6th Nov 2011, Dept. of ICE, MIT, Manipal.
9. Organizing member for the National Symposium on Space Engineering and Sciences conducted by the Dept. of ICE, MIT, Manipal-2011.
10. Convener for the **AICTE-BRNS sponsored FDP** on Advanced Process Control and Systems scheduled during 6th-10th Jan. 2014.
11. Coordinator for the **MHRD-ISTE** two-week workshop on “Control Systems” held at MIT, Manipal Remote Center(ID:1033) during 2nd-12th Dec. 2014.
12. Co-Coordinator for the three-day workshop on “Navigation, Guidance and Control”, Dept. of ICE, MIT, Manipal. April-2016.
13. Co-Coordinator for the two-day workshop on “Internet of Things”, Dept. of ICE, MIT, Manipal. Sep. 2016.
14. Co-Coordinator for the five-day FDP on “PLC, SCADA, HMI and Analog Systems”, Dept. of ICE, MIT, Manipal. Dec 2016.
15. Organized a guest lecture on “Control Systems: Transfer Function and State Variable Approach”, 25th Sep. 2017, Dept. of ICE, MIT, Manipal.
16. Coordinator “Three days SDP on PID Controllers: Theory, Practice and Research”, ICE Dept., Nov 2019.
16. Coordinator “Two Weeks AICTE FDP on Robust H-Infinity Adaptive and Optimum Control”, ICE Dept, 17-29 June 2019.
17. Coordinator “ATAL- AICTE Sponsored Five days online FDP on Control Systems for Aerospace Applications with Sensor Technology”, 19th-23rd Jan 2021.

WORKSHOPS / SDP/ SEMINARS ATTENDED:

@ QIP-STC’s attended in **Institute of National Importance** (IITs & NITs)

1. Five days **QIP-STC** on “Thermodynamic Analysis of Modern Separation Process” held at **IIT Madras**, Chennai during 23rd-28th Nov. 2014. (**Instructor Prof.Kannan**)
2. Five days **QIP-STC** on “Process Control”, Dept. of Chemical Engg., **IIT Madras**, Chennai during 15th Dec 14 to 19th Dec 14. (**Instructor Prof.M.Chidambaram**)
3. Five days **QIP-STC** on “Dynamics and Control in State Space”, Dept. of Aeronautics, **IIT, Bombay** during 18th -22nd May 2015. (**Instructor Prof.Ashok Joshi**)
4. **TEQIP- STC** sponsored Five (5) days on “Fixed Point Theory and Nonlinear Analysis and its application” in Dept. of Mathematics, **SVNIT, Surat** during 30th June-4th July 2014 (**Instructor: Dr.Vishnu Mishra**)

5. Five days **QIP-STC** on “Real Time Embedded Systems” conducted by Dept of CSE, **IIT-KGP**, 13th - 17th Feb 2008. (**Instructor Prof.Rajib Mal**)
6. Five days **QIP-STC** on “Analysis and Design of Classical Control Systems” conducted by Aerospace Dept., **IIT, Bombay** during 11th -15th June 2012. (**Instructor Prof.Ashok Joshi**)
7. One day Tutorial Session on “PID Controllers” by **Dr.S.P.Bhattacharya** , Texas A&M University, organized by Dept. of ICE,**NIT-Trichy**. 27th Dec 2007.
8. The Three days “Workshop on Challenges in Control Engineering”, organized by the dept of ICE, **NIT, Trichy**. (**Instructor: Dr.A.Ramakalyan**)
9. The **UKIERI** workshop on “Control of Smart Reliable and Adaptable Air Vehicles” during 4th-6th Dec 2009, Dept of ICE, **NIT, Trichy**. (**Instructor: Dr.A.Ramakalyan**)
10. Four days **STC** on “Modern Techniques on Nonlinear Robust Control”, 7th-10th August 2017, **IIT-Roorkee**, (**Instructor: Dr.Soham Chakraborty & Dr.Manas Bera**).
11. Five days **MHRD GIAN course** on “Waste Water Treatment” organized by Dept. of Civil Engg., **NIT, Patna**. Dec. 2018 (**Instructor: Dr.Ramesh Goel, University of Utah, USA**)
12. Seven days **AICTE QIP STC** on Robotics, Dept of Mechanical Engg., **IIT KGP**, 13th-19th Nov. 2019 ((**Instructor: Dr.Dilip..K.Prathikar**))

FDP/ STC attended in Private/State Govt. Institutions

13. **AICTE** thirteen (13) days SDP on “Digital System Design Using FPGA’s” conducted by Dept of EEE, MIT-Manipal, 23rd June to 7th July 2007 (**Instructor Prof.Vinod Thomas**)
14. **AICTE** five days FDP on “Graphical System Design using LabVIEW” organized by the Dept. of EEE, MIT, Manipal during 15th-19th July 2013.
15. Five Days SDP on “Modern Controller Design Tech” conducted by the Dept of ICE,MIT, Manipal – 9th -13th June 2008. (**Instructor: Dr.V.I.George**)
16. Twelve Days SDP on “Non Linear Control System” conducted by the Dept of CFD/EEE, **Anna University**, Chennai – 4th-16th Dec 2006. (**Instructor: Dr.G.Uma**)
17. A course of training in PLC conducted by **SISI, Govt of India**, Chennai.18th -22nd June 2002.
18. The two days “National seminar on Instrumentation Engineering-Practices, Teaching and Research”, Dept of Instrumentation, **MIT, Anna University**, 27th -28th Oct 2006. (**Instructor: Dr.J.Prakash**)
19. The one day workshop on “Real Time Embedded system” conducted by Dept of EIE, RMK Engg College, Chennai. 7th April 2007.
20. . One day hands on practice in ARM Processor, **Anna University**-Chennai
21. The **UGC sponsored** STC on “Goal Oriented System Modeling and Identification”, conducted by Dept of Instrumentation Engg, **Annamalai University**. 7th-8th Jan 2009. (**Instructor: Dr.D.Siva Kumar**)
22. The “Linear Algebra Application in Engineering and Sciences”, by Dept. of Mathematics, MIT, Manipal University during 19th-20th August 2011.
23. The two day workshop on “PID controller design and advanced process control” organized by the Dept. of EIE, Karpagam University, Coimbatore during 16th-17th Dec 2011.
24. Three day workshop on “MATLAB-2012: An Extensive Usage” organized by Dept. of Continuing Education, MIT, Manipal

25. Two day workshop on “PID Controller”, organized by Instrumentation Engg., MIT, Anna University during 22nd-23rd Sep 2012. (**Instructor: Dr.J.Prakash**)
26. Three days **FDP** on “Nonlinear Control Systems”- Lecture by **Prof.Ravi.N.Banavar,IIT Bombay**, Dept. of ICE, MIT, Manipal. 8th-10th Jan 2015.
27. Two days **FDP** on Recent Measurement Science, Dept. of Mechanical Engineering, NITTE, March 2016.
28. Two days Research Oriented FDP on Applied Machine Learning, Dept. of Instrumentation Engg., MIT Anna University, 9th-10th March 2020.
29. One Week Online FDP on Insights on writing research proposals and funding opportunities”, Organized by Research & Facilities Group, St. Joseph Engineering College, Mangalore during 20th-24th July 2020.
30. **ATAL-AICTE** Five Days FDP on Control Systems and Sensor Technology during 19th-23rd Jan 2021, Dept. of ICE, MIT, Maniapl.
31. **ATAL AICTE** Five Days FDP on Advanced Process Control during Feb 2021, Dept. of EEE, **NIT Calicut**.
32. **GIAN Course** on Soft Sensor Development, College of Engg, Guindy, **Anna University, 11-16 July 2022.** (**Instructor: Prof. J. Prakash**)

Guest Lectures Delivered [Interaction with outside world]

1. “Introduction to conventional controllers and robust controllers – An Overview” at NMAMIT, Nitte, Karkala.
2. “Design and Implementation of advance control algorithms using MATLAB” at VNR Vignan Jothi College of Engineering and Technology, Bochupali, Hyderabad **supported by TEQIP-II**
3. “Nonlinear Controllers for Nonlinear Processes” at M.S.Ramaiah Institute of Technology, Bangalore **supported by TEQIP-II**
4. “Design and implementation of 2DOF PID controllers for a nonlinear process”, Karpagam University, Coimbatore.
5. “MAPLE for Complex Equations and Inequality Problems”, 5 Days STTP on AFPTNLES-2014, SVNIT, Surat. **Supported by TEQIP-II.** 29th June -4th July 2014
6. “Nonlinear Actuators” in Anna University sponsored FDP on “Robotics & Automation”, Dept. of ICE, Tamilnadu college of Engineering, Coimbatore, TN. 22nd Dec. 2014.
7. “Design of Nonlinear PID for a Conical Tank System”, Dept. of EIE, SCVMV, Kanchipuram, 12th Feb. 2015.
8. “Nonlinear Distillation Process MIMO system modeling” in “Potential avenues for research in Instrumentation, Power System”, Two day workshop held in Karpagam College of Engineering, Coimbatore. 5th-6th Feb 2015.
9. “Design of Nonlinear Control Systems” to 6th Sem. EIE students of Sri Vidyanikethan Engineering College, Thirupathi on 30th March 2015. (**Supported by TEQIP-II, Govt. of India**)

10. “Soft computing Techniques for nonlinear processes”, FDP on Soft Computing and its engineering applications, M.S.Ramaiah Institute of Technology, Bangalore. 12th August 2015. **(Supported by TEQIP-II, Govt. of India)**
11. “Nonlinear Control of MIMO processes”, Potential avenues for research in Instrumentation, Power System”, Two day workshop held in Karpagam College of Engineering, Coimbatore. 25th-26th Feb 2016.
12. “Design of Nonlinear 2DOF PID Controller for a nonlinear process – Real time implementation”, ACIIT-2016, Dept. of EIE, Kongu Engg. College, Perundurai. 7th March 2016.
13. “Controller tuning for Non-Linear Process”, Dept. of ICE/ Dept. of Chemical Engg., AMACE, Kanchipuram, 12th July 2016. Arranged **under IEEE Madras Chapter.**
14. “Nonlinear Controller design for the MIMO process”, 12th Feb. 2017, Dept. of EIE, Karpagam College of Engineering, Coimbatore.
15. Delivered **seven webinars** in various Govt. /Private engineering colleges with advanced control algorithms applied to various pilot plant operations during COVID-19.
16. “Data Driven Modeling and NMPC design for a Batch Reactor”, ATAL FDP on Industry 4.0, Dept. of EIE Kongu Engineering College, Erode. 19th August 2021

B.E Projects Guided (Best Selected from In-house project)

1. Improved IMC Using Marquardt optimization algorithm for time delayed systems.
2. An approach of Frequency based controller design for integral time delayed processes.
3. Design of PID Controller for Unstable & Integrating Processes with dead time.
4. Robust controller design for the Integral process with dead time.
5. PID Controller for the robust performance.
6. PID Controller design based on the Equating Co-Efficient Method.
7. Identification of Unstable Process with Optimization Method.
8. Digital PID Controller design for the Time delayed system (Using IMC design Tech.)
9. LabVIEW based Robust PID controller design.
10. Certain analysis of Robust PID controllers for the Ball and Beam arrangement- An real time experimentation.
11. Analog 2DOF PID controller for processes with dead time.
12. Frequency based Robust PI controller design.
13. Anti-reset windup based on the low frequency gain and H^∞ .

14. 2DOF Modified Smith Predictor for the processes with dead time.
15. Design and Implementation of SMC for the Conical Tank System.
16. Identification and Non-Linear PID controller design for the Heat Exchanger system.
17. Design of MPC for the SISO (Conical) and MIMO (Distillation Column) systems.
18. Design of DMC based PID controller for the Shell and Tube heat exchanger.
19. Design of DMC and DMC PID Controller for the SISO and MIMO process.
20. Predictive PI Controller for the Conical Tank process.
21. Integral MPC for Distillation Column Control.
22. Temperature Trajectory Optimization and Nonlinear Control Design for a Batch Reactor.
23. Design, Simulation and Implementation of Split Range and Cascade Control for a Lab Scale Batch Reactor.
24. Weiner Model Identification and Nonlinear PI Control validation for the batch reactor pilot plant.
25. Artificial Intelligence based model identification and design of GMC for a batch reactor.
26. Implementation of NMPC & SMC controllers on a Quadrotor setup for trajectory tracking problem.

M.Tech Projects Guided (In-house project)

1. **Mrs.Vinayambika.H**, (2008) “Robust PID Controller design for the Pure Integral Process with a combination of PADE approximation for the time delay” (Under NMAMIT, Nitte, VTU, Belagavi, Guide. Prof. Dr. S. Narayana Iyer)
2. **Mr.Bipin Krishna**, (2009)“Hybrid controller design for the Rotary Inverted Pendulum”.
4. **Mrs.Jeane Maria D’Souza**, (2010) “First Order Controller design based on the H-Infinity Principles”.
5. **Mr.Rakesh**(2014), “Design of Non-Linear Controller for the Conical Tank System”
6. **Mr.Mithun.P**, (2015) “GMC and Adaptive controller for a Shell and Tube Heat Exchanger”.
7. **Mr.C.P.Praveen Kumar**,(2016) “Constrained MPC for the MIMO Process”.
8. **Ms.Sreelatha.C**, (2017)“Kalman Filter Estimation and Control of Binary Distillation Column”(Guide: **V.I.George**)
9. **Mr.Bharath K Udupa**,(2017) “Robust MPC for a Binary Distillation Column”.
10. **Mr.Ganesh.U.G**,(2017) “Relay based Identification of a MIMO system”.
11. **Ms.Susmitha Poojary**(2020), “NARX model identification, design and implementation of NMPC on a lab scale Batch Reactor”.

12. **Mr.Prajwal Shettigar,(2021)**, “NMPC and NMBC controller design for the pilot plant Batch Reactor”
13. **Mr.Sangamesvaran.S,** (2021), “Mathematical Modeling and Design of Nonlinear Controller for MAV
14. **Mr.Sanjay James,** “*Nonlinear Estimator based Nonlinear Controllers for a Quadrotor Model*”.- **On Going**
15. **Mr.Vineet D’Souza,** “*Integral SMC for a Quadrotor Model*”- **On Going**
16. **Ms.Sonu,** “*Obstacle Avoidance Algorithms with NMPC for Autonomous UAV*”- **On Going**
17. **Mr.Karthick,** “*Reinforcement Learning based Nonlinear Controller for an Autonomous Vehicle*”- **On Going**
18. **Ms.Sreelakshmi,** “*Data Driven Modeling and TS Fuzzy clustering design for an UAV*”- **On Going**
- 19 **Mr.Anjay Ranjan,** “*Artificial Intelligence based SMC for a Multirotor Aircraft*” - **On Going**

Ph.D Guidance:

1. **Dr.Vinayambika.S.Bhat,**(Reg. No: 150900015) Professor & Head-ECE, MITE, Mangalore– “Design and Validation of Robust Controller for a Binary Distillation Column”.–(Deputed on study leave from Mangalore Institute of Technology & Engineering, Moodabidri, Mangalore).(Completed VIVA on 25th August 2018) – **Examiner Prof. Ramakalyan. A, ICE Dept., NIT Trichy.**
2. **Dr.Cyril Joseph** (Reg. No: 090900020) – “Controller Synthesis for Complementarity Hybrid Dynamical System”. (Completed VIVA on Sep. 2018) – As Co-Guide. Examiner **Prof. G. N. Pillai, EE,IIT Rourke.**
3. **Dr.R.Janani,** (Reg. No: RM15E162) “Design of Robust PID Controller for a Binary Distillation Column”, SCSVMV University, Enathur, Kanchipuram. (VIVA VOCE, 9th April 2021)- **Examiner Prof. Giuseppe Fedele, Univ. of Calabria, Italy.**
4. **Dr.Sarath Yadav,** (Reg. No: 160900032) “Design, Implementation and Validation of Control Schemes on the Batch Distillation Column” (VIVA VOCE completed on 5th August 2020). Examiner: **Prof.M.Chidambaram-Emeritus Prof-Chemical Engg., NIT Warangal, Ex-Director-NIT Trichy, Ex-Prof & Head - Chemical Engineering, IIT M.,)**
5. **Ms.Tinu Valsa Paul,** (Reg. No: 190900107) “Model Validation and Design of Robust Controller for Non-linear Dynamics of Quadrotor” (August 2019-Till date) – (**Dr.J.Prakash, MIT-Anna Univ. / Dr.Ambalal.Vinayak Patil, NAL–DAC Members**) - Third DAC Completed

6. Mr.Suraj Suresh Kumar, (Reg. No: 200900017) JRF, ISRO Project on SMC for Quadrotor & PhD in “Design and Simulation of Advanced Non-Linear Controllers for MAV” (Sep 2020 to Till date) (**Dr.J.Prakash, MIT Anna Univ. / Dr.Vijay Vinayak Patil, NAL–DAC Members**) - Second DAC Completed on 6th Nov 2021.

IAESTE Projects Guided (International Students)

1. Admissible set of Robust PID Controller Using Hurwitz Criterion for the Pure Integrating Process with Dead Time.
2. Design of Lower Order Controller H-Infinity Controller
3. Controller tuning for the Rotary Inverted Pendulum
4. PID controller tuning based on the phase margin and gain margin.
5. Tracking and Back-Calculation based Anti-reset windup PID Controller scheme.
6. PID Controller for Magnetic Levitation System using D-Curve method.
7. Investigations on best suitable controller for Ball and Beam System –An Experimentation.
8. Analysis of stable region of PID Controller using GM and PM.
9. Sliding Mode Controller design for the chemical processes.
10. Implementation of various control algorithms for the conical tank system.
11. State Estimation and realization of MPC algorithms in a Binary Distillation Column.

Services offered to Govt. of India

1. Served as election officer in the parliament election 2009.
2. Served as an observer for the AIEEE examinations during 2009 (Ernakulum Center), 2011(Hyderabad Center), 2012(Warangal Center).