ALI ARSHAD, Ph.D, Senior Member IEEE
(Post doc, U. Porto, Portugal & Visiting Scholar, OSU, USA)

Contact Information

Tenured Associate Professor,
Department of Electrical & Computer Engineering,
COMSATS University Islamabad,
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- Google Scholar Citations
- ResearchGate Profile

Research Interests

Nonlinear control; Optimal control; Process control; Artificial intelligence in control systems; Control of distributed parameter systems; Control of energy conversion systems.

Professional Experience

- **Department of Electrical and Computer Engineering, COMSATS University Islamabad (CUI)**, Islamabad, Pakistan

  Tenured Associate Professor **July 2023 – Present**

  - Teaching at graduate and undergraduate level
  - Supervision/Co-supervision of MS and Ph.D. theses and undergraduate projects
  - Head of Control and Energy Systems Research group

- **Department of Electrical and Computer Engineering, COMSATS University Islamabad (CUI)**, Islamabad, Pakistan

  Assistant Professor **Apr 2014 – Feb 2015, Jan 2016 – Sep 2020, Sep 2021 – June 2023**

  - Teaching at graduate and undergraduate level
  - Supervision/Co-supervision of MS and Ph.D. theses and undergraduate projects
  - Head of Control and Energy Systems Research group

- **Electrical & Computer Engineering Department**, University of Porto, Porto, Portugal

  Doctoral Researcher **Sep 2020 – Sep 2021**

  - Research Project: **FCT UPWIND: A Multi-Kite System to Harvest High Altitude Wind Power**

    - Modelling and parametrization of the induction machine (IM)
    - Development of observer based rotor flux-oriented control of the IM
    - Development of a robust cascade control of the ground station module of the airborne wind energy system (AWES) in all operational phases
    - Development of the supervisory controller for the AWES

- **Electrical & Computer Engineering Department**, The Ohio State University, Columbus, Ohio, USA

  Visiting Scholar **Feb 2015 – Jan 2016**

  - Research Project: **Model-Based Control of the Underground Coal Gasification (UCG) Process**
    - Development of a simplified time domain model of UCG
    - Development of the model based control of the process based on Sliding Mode Control theory
    - Implementation of the developed controller on the actual process model
    - The stability of the zero dynamics, which guarantees the overall stability of the closed loop system

- **Control & Signal Processing Research Group**, Capital University of Science & technology, Islamabad, Pakistan

  Professional Researcher **May 2012 – April 2014**

  - Research Project: **ICT R& D Funds: Simulation and Control of the UCG process**
    - Development of the one-dimensional packed bed reactor model for Thar underground coal gasifier
    - Numerical solution of the developed model
    - Computer simulation of the numerical solution techniques
    - Parameter estimation for the UCG process
    - Model validation with actual field trials
    - Robust control system design for obtaining a desired calorific value of the product gas mixture

- **Department of Electrical and Computer Engineering,** COMSATS University Islamabad, Islamabad, Pakistan

  Lecturer **Apr 2008 – May 2012**

  - Teaching at undergraduate level
  - Supervision of undergraduate projects
  - Designed and conducted labs for Electric Machines and Control System

- **Public Sector Organization**, Islamabad, Pakistan

  Design Engineer **Aug 2007 – April 2008**

– Integration and testing of electronic modules

Educational Background

Doctor of Philosophy in Electrical Engineering (*Control Systems*) **Feb 2012 – July 2016**
COMSATS University Islamabad, Islamabad, Pakistan

- Thesis Title: Modeling and Control of Underground Coal Gasification

Masters of Science in Computer Engineering (*Control Systems*) **Feb 2009 – Dec 2011**
University of Engineering & Technology, Taxila, Pakistan

- Thesis Title: Dynamic Modeling and Nonlinear Controller Design For Underground Coal Gasification

Bachelors of Science [With Hons] in *Electrical Engineering* **Jan 2003 – Nov 2006**
University of Engineering & Technology, Taxila, Pakistan

- Pakistan Engineering Council (PEC) Registration No: Elect-22971

Publications

29 impact factor journal publications and 5 conference proceedings.

- **Published Journal Papers**

29. Ahmed A, **A.A.Uppal**, Javed SB., "Nonlinear-Control-Oriented Modeling of the Multi-Variable Underground Coal Gasification Process for UCG Project Thar: A Machine Learning Perspective", *Journal of process control*, vol. 131, 2023, DOI: https://doi.org/10.1016/j.jprocont.2023.103090.
28. Ahmed A, Javed SB, **A.A.Uppal**, Iqbal J., "Development of CAVLAB—A Control-Oriented MATLAB Based Simulator for an Underground Coal Gasification Process", *Mathematics*, vol. 11, pp. 2493, 2023, DOI: https://doi.org/10.3390/math11112493.
27. Ahmad, S.; **A.A.Uppal**; Azam, M.R.; Iqbal J., "Chattering Free Sliding Mode Control and State Dependent Kalman Filter Design for Underground Gasification Energy Conversion Process", *Electronics*, vol. 12, pp. 876, 2023, DOI: https://doi.org/10.3390/electronics12040876.
26. U. Javed, A. Mehmood, J. Iqbal, **A.A.Uppal**, "Neural network and URED observer based fast terminal integral sliding mode control for energy efficient polymer electrolyte membrane fuel cell used in vehicular technologies", *Energy*, vol. 269, pp. 126717, 2023, DOI: https://doi.org/10.1016/j.energy.2023.126717.
25. I. U. Rehman, S. B. Javed, A. M. Chaudhry, M. R. Azam, **A.A.Uppal**, "Model-Based Dynamic Sliding Mode Control and Adaptive Kalman Filter Design for Boiler-Turbine Energy Conversion System", *Journal of Process Control*, vol. 116, pp. 221–233, 2022, DOI: https://doi.org/10.1016/j.jprocont.2022.06.006.

24. M. Hassam, M. K. Ishak, A. Hanif, **A.A.Uppal**, A. I. Bhatti, and N. A. M. Isa, "Virtual Sensor Using a Super Twisting Algorithm Based Uniform Robust Exact Differentiator for Electric Vehicles", *Energies*, vol. 15, no. 5, 2022, DOI: https://doi.org/10.3390/en15051773.

23. U. Javed, J. Iqbal, A. Mehmood, **A.A.Uppal**, "Performance Improvement in Polymer Electrolytic Membrane Fuel Cell based on Nonlinear Control Strategies - A Comprehensive Study", *PLOS ONE*, vol. 17, no. 2, 2022, DOI: https://doi.org/10.1371/journal.pone.0264205.

22. **A.A.Uppal**, M. C. R. M. Fernandes, S. Vinha, and F. A. C. C. Fontes, "Cascade Control of the Ground Station Module of an Airborne Wind Energy System", *Energies*, vol. 14, no. 22, Dec. 2021, DOI: https://doi.org/10.3390/en14248337.

21. S. Bano, M. R. Azam **A.A.Uppal**, S. B. Javed and A. I. Bhatti, "Robust p53 Recovery Using Chattering Free Sliding Mode Control and a Gain-Scheduled Modified Utkin Observer", *Journal of Theoretical Biology*, vol. 532, pp. 110914, 2022, DOI: https://doi.org/10.1016/j.jtbi.2021.110914.

20. M. Riaz, A. R. Yasin, **A.A.Uppal**, and A. Yasin, "A Novel Dynamic Integral Sliding Mode Control for Power Electronic Converters", *Science Progress*, vol. 104, no. 4, pp. 1–16, 2021, DOI: https://doi.org/10.1177/00368504211044848

19. A. M. Chaudhry, **A.A.Uppal** and S. Bram, "Model predictive control and adaptive Kalman filter design for an underground coal gasification process", *IEEE Access*, vol. 9, pp. 130737–130750, September 2021, DOI: https://doi.org/10.1109/ACCESS.2021.3114260.

18. M. Armaghan, Y. M. Alsmadi, **A.A.Uppal**, and S. M. Gulfam, "A Modified Simplex Based Direct Search Optimization Algorithm for Adaptive Transversal FIR Filters", *Science Progress*, vol. 104, no. 2, pp. 1–19, April 2021, DOI: https://doi.org/10.1177/00368504211025409.

17. M. Khattak, **A.A.Uppal**, Q. Khan, A. I. Bhatti, Y. M. Alsmadi, V. I. Utkin and I. Chairez, "Neuro-adaptive Sliding Mode Control for Underground Coal Gasification Energy Conversion Process", *International Journal of Control*, 2021, DOI: https://doi.org/10.1080/00207179.2021.1909745.

16. S. B. Javed, V. I. Utkin, **A.A.Uppal**, R. Samar and A. I. Bhatti, "Data-Driven Modeling and Design of Multi-variable Dynamic Sliding Mode Control for the Underground Coal Gasification Project Thar", *IEEE Transactions on Control Systems Technology*, vol. 30, no. 1, pp. 153–165, 2021, DOI: https://doi.org/10.1109/TCST.2021.3057633.

15. Y. M. Alsmadi, I. U. Rehman, **A.A.Uppal**, V. I. Utkin, I. Chairez and M. Ibbini, "Super-Twisting Based Sliding Mode Control of Drum Boiler Energy Conversion Systems", *International Journal of Control*, 2021, DOI: https://doi.org/10.1080/00207179.2021.1884293.

14. S. B. Javed, **A.A.Uppal**, R. Samar and A. I. Bhatti, "Design and Implementation of Multi-variable H_∞ Robust Control for the Underground Coal Gasification Project Thar", *Energy*, vol. 216, 2021, 119000, DOI: https://doi.org/10.1016/j.energy.2020.119000.

13. Q. Irum, S. A. Khan, **A.A.Uppal** and L. Krivodonova, "Galerkin Finite Element Based Modeling of One Dimensional Packed Bed Reactor for Underground Coal Gasification (UCG) Process", *IEEE Access*, vol. 8, pp. 223130-223139, 2020, DOI: https://doi.org/10.1109/ACCESS.2020.3044194.

12. U. Javaid, A. Mehmood, **A.A.Uppal**, F. Imtiaz and J. Iqbal "Operational Efficiency Improvement of PEM Fuel Cell–A Sliding Mode Based Modern Control Approach", *IEEE Access*, vol. 8, pp. 95823-95831, 2020, DOI: https://doi.org/10.1109/ACCESS.2020.2995895.

11. M. Ilyas, J. Iqbal, S. Ahmad, **A.A.Uppal**, W. A. Imtiaz and R. A. Riaz, "Hypnosis regulation in propofol anesthesia employing super-twisting sliding mode control to compensate variability dynamics", *IET Syst. Biol.*, vol. 14, no. 2, pp. 59–67, 2020, DOI: https://doi.org/10.1049/iet-syb.2018.5080.

10. A. R. Yasin, M. Ashraf, A. I. Bhatti, **A.A.Uppal**. "Fixed frequency sliding mode control of renewable energy resources in DC micro grid". *Asian J Control*, vol. 21, no. 4, pp. 2074–2086, 2019, DOI: https://doi.org/10.1002/asjc.2057.

9. M. R. Azam, V. Utkin, **A.A.Uppal** and A. I. Bhatti, "A Sliding Mode Controller-Observer Pair for p53 Pathway", *IET Syst. Biol.*, vol. 13, no. 4, pp. 204–211, 2019, DOI: https://doi.org/10.1049/iet-syb.2018.5121.

8. Y. M. Alsmadi, A. M. Abdelhamed, A. E. Ellissy, A. S. El-Wakeel, A. Y. Abdelaziz, V. I. Utkin and **A.A.Uppal**, "Optimal Configuration and Energy Management Scheme of an Isolated Micro-Grid using Cuckoo Search Optimization Algorithm", *Journal of the Franklin Institute*, vol. 356, no. 8, pp. 4191–4214, 2019, pp.1-29, DOI: https://doi.org/10.1016/j.jfranklin.2018.12.014.

7. S. B. Javed, **A.A.Uppal**, A. I. Bhatti and R. Samar, "Prediction and Parametric Analysis of Cavity Growth for the Underground Coal Gasification Project Thar.", *Energy*, vol. 172, pp. 1277–1290, 2019, DOI: https://doi.org/10.1016/j.energy.2019.02.005

6. **A.A.Uppal**, S. S. Butt, Q. Khan, H. Aschemann, "Robust tracking of the heating value in an underground coal gasification process using dynamic integral sliding mode control and a gain-scheduled modified Utkin observer", *Journal of Process Control*, vol. 73, pp. 113 -– 122, 2019, DOI: https://doi.org/10.1016/j.jprocont.2018.11.005.

5. A. M. Chaudhry, **A.A.Uppal**, Y. M. Alsmadi, A. I. Bhatti and V. I. Utkin, "Robust Multi-Objective Control Design for Underground Coal Gasification Energy Conversion Process", *International Journal of Control*, vol. 93, no. 2, pp. 328–335, 2020, DOI: https://doi.org/10.1080/00207179.2018.1516893.

4. **A.A.Uppal**, Y. M. Alsmadi, V. I. Utkin, A. I. Bhatti and S. A. Khan, "Sliding Mode Control of Underground Coal Gasification Energy Conversion Process", *IEEE Transactions on Control Systems Technology*, vol. 26, no. 2, pp. 587–598, March 2018, DOI: https://doi.org/10.1109/TCST.2017.2692718.

3. I. Khan, A.I. Bhatti, **A.A.Uppal**, and Q. Khan. "Robustness and performance parametrization of smooth second order sliding mode control", *International Journal of Control, Automation, and Systems*, vol. 24, no. 3, pp. 681–690, June 2016, DOI: http://dx.doi.org/10.1007/s12555-014-0181-6.

2. **A.A.Uppal**, A. I. Bhatti, E. Amir, R. Samar and S. A. Khan. "Optimization and Control of one dimensional packed bed model of underground coal gasification", *Journal of process control*, vol. 35, pp. 11 – 20, Aug 2015, DOI: https://doi.org/10.1016/j.jprocont.2015.08.002.
1. **A.A.Uppal**, A. I. Bhatti, E. Amir, R. Samar and S. A. Khan. "Control oriented modelling and optimization of one dimensional packed bed model of underground coal gasification", *Journal of process control*, vol. 24, no. 1, pp. 269 – 277, Jan 2014, DOI: https://doi.org/10.1016/j.jprocont.2013.12.001.

- **Journal Papers Submitted/Under review**

1. S. B. Javed, **A.A.Uppal**, M. R. Azam, Q. Ahmed "Model-Based Quantitative Analysis of Active Cell Balancing Techniques Considering Static and Dynamic Parameters", *submitted in IEEE Transactions on Transportation and Electrification*, 2023
2. **A.A.Uppal**, S. B. Javed, M. R. Azam and Q. Ahmed "Power Losses Aware Nonlinear Model Predictive Control Design for Active Cell Balancing", *submitted in IEEE Control Systems Letters*, 2023

- **Conference Proceedings**

5. S. B. Javed, **A. A. Uppal**, M. R. Azam, K. Shehzad, Q. Ahmed, Model-Based Quantitative Analysis of a Capacitive Cell Balancing Technique using SoC Estimator *2022 IEEE Conference on Control Technology and Applications (CCTA), Trieste, Italy, 2022, pp. 670-675*, DOI: https://doi.org/10.1109/CCTA49430.2022.9966110.
4. **A. A. Uppal**, S. S. Butt, A. I. Bhatti, and H. Acshemann, Integral sliding mode control and gain-scheduled modified Utkin observer for an underground coal gasification energy conversion process *In 23rd International Conference on Methods and Models in Automation and Robotics, (MMAR)*, pp. 357-–362, Aug 2018, DOI: https://doi.org/10.1109/MMAR.2018.8486053.
3. G. Murtaza, A. I. Bhatti, Q. Ahmed and **A. A. Uppal** Nonlinear Robust Control of Atkinson Cycle Engine *IFAC-PapersOnLine*, vol. 50, no. 1, pp. 3685– 3690, 2017. 20th IFAC World Congress, DOI: https://doi.org/10.1016/j.ifacol.2017.08.562.
2. M. R. Azam, A. I. Bhatti, **A. A. Uppal** and M. Z. Babar Sensitivity analysis of Wnt Signaling Pathway *In Proceedings of 2013 10th International Bhurban Conference on Applied Sciences Technology (IBCAST)*, pp. 122–127, Jan 2013.
1. **A. A. Uppal**, A. I. Bhatti, R. Samar, Q. Ahmed and E. Aamir Model Development of UCG and Calorific Value Maintenance via Sliding Mode Control *In 2012 International Conference on Emerging Technologies*, pp. 1–6, Oct 2012, DOI: https://doi.org/10.1109/ICET.2012.6375477.

Teaching Experience

Graduate courses at COMSATS University Islamabad

- Taught Intelligent Control Systems (ECI761) in Spring 2022
- Taught Nonlinear Systems and Controls (ECI760) in Fall 2021 and Fall 2022

- Taught Linear Control Systems (ECI660) in Fall 2019
- Taught Linear Systems Theory (ECI665) in Spring (2017, 2018 and 2019) and Fall 2017
- Taught Robust Control Systems (ECI765) in Fall 2018

Undergraduate courses at COMSATS University Islamabad

- Taught Electronics-I (EEE231) in Fall 2022
- Taught Control Systems (EEE325) from 2011–2021 and Spring 2023
- Taught Electric Machines (EEE371) from 2008–2011 and Spring 2023

Student Supervision

Ph.D. students

5. Muhammad Shakeel, COMSATS University Islamabad (2019–present)
   supervisor: **Dr. Ali Arshad**,
4. Azmat Ullah, COMSATS University Islamabad (2019–present)
   supervisor: **Dr. Ali Arshad**, co-supervisor: Dr. Rizwan Azam
3. Usman Javed, COMSATS University Islamabad (2016–2023)
   supervisor: **Dr. Ali Arshad**, co-supervisor: Dr. Adeel Mehmood
2. Qudsiya Irum, COMSATS University Islamabad (2016–2022)
   supervisor: Prof. Shahid A. Khan, co-supervisor: **Dr. Ali Arshad**
1. Syed Bilal Javed, Capital University of Science & Technology, Islamabad (2016–2021)
   supervisor: Dr. Raza Samar, co-supervisor: **Dr. Ali Arshad**

MS students

11. Imran Ahmed, COMSATS University Islamabad (2021–2023)
    supervisor: Dr. Rizwan Azam, co-supervisor: **Dr. Ali Arshad**
10. Afaq Ahmed, COMSATS University Islamabad (2021–2023)
    supervisor: **Dr. Ali Arshad**, co-supervisor: Dr. Syed Bilal Javed
9. Owais Shaukat, COMSATS University Islamabad (2021–present)
   supervisor: **Dr. Ali Arshad**, co-supervisor: Dr. Syed Bilal Javed
8. Sara Sarfraz, COMSATS University Islamabad (2019–2021)
   supervisor: **Dr. Ali Arshad**, co-supervisor: Dr. Qudrat Khan
7. Shehar Bano, COMSATS University Islamabad (2018–2020)
   supervisor: **Dr. Ali Arshad**, co-supervisor: Dr. Rizwan Azam
6. Fajar Mukhtar, COMSATS University Islamabad (2018–2020)
   supervisor: **Dr. Ali Arshad**, co-supervisor: Dr. Syed Bilal Javed
5. Sohail Ahmed, COMSATS University Islamabad (2018–2020)
   supervisor: **Dr. Ali Arshad**

4. Bilal Arif, COMSATS University Islamabad (2018–2020)
   supervisor: prof. Shahid A. Khan, co-supervisor: **Dr. Ali Arshad**
3. Mutahir, COMSATS University Islamabad (2016–2018)
   supervisor: prof. Shahid A. Khan, co-supervisor: **Dr. Ali Arshad**
2. Imtiaz Ur Rehman, COMSATS University Islamabad (2016–2018)
   supervisor: prof. Shahid A. Khan, co-supervisor: **Dr. Ali Arshad**
1. Fahad Imtiaz, COMSATS University Islamabad (2014–2016)
   supervisor: Dr. Adeel Mehmood, co-supervisor: **Dr. Ali Arshad**

Presentations & Workshops

Presentations

5. "Model Predictive Control Design for Targeted Drug Therapy to Recover p53 in Cancer Treatment", Portuguese Meeting on Optimal Control, 2021
4. "AI Based Control of Industrial Processes", IEEE 2021 International Conference on Digital Futures and Transformative Technologies, School of Electrical Engineering and Computer Science (SEECS), National University of Science and Techbology (NUST), Islamabad, Pakistan, 2021 (Guest speaker)
3. "Sliding mode control of the underground coal gasification energy conversion process", Symposium on Control Systems, School of Electrical Engineering and Computer Science (SEECS), National University of Science and Techbology (NUST), Islamabad, Pakistan, 2019 (Guest speaker)
2. "Development of a simplified control-oriented model of the underground coal gasification process ", Department of Electrical Computer Engineering, The Ohio State University, Columbus, OH, USA, 2015
1. "Development of a one-dimensional packed bed model of the underground coal gasification process for Thar coal gasifier", UCG Project Thar, Tharparkar, Pakistan, 2013

Workshops

2. Conducted a one day workshop on "LaTeX–The Way of Scientific Writing" at the department of Electrical and Computer Engineering, COMSATS University Islamabad on 17 October 2022
1. Conducted three (one day) workshops on LaTeXat Capital University of Science & Technology, Islamabad on March 13 2018, July 17 2019 and August 5 2021, respectively

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Technical Skills

- Linear/Nonlinear controller & observer Design
- Sliding mode control
- Process control
- Optimal Control

Computer Skills

- MATLAB/SIMULINK
- Maple
- Microsoft Office
- C++
- Mathematica
- LaTeX

Research Activities

- Senior Member IEEE
- Member IEEE Control Systems Society and IEEE Power and Energy Society
- Guest Editor for the special issue, "Sliding Mode Control in Dynamic Systems" in MDPI Electronics
- Reviewer for the Journal of process control, Fuel, IEEE Transactions on Mechatronics, IEEE Access, PloS One, Frontiers of Information Technology & Electronic Engineering, American Control Conference and International Journal of Hydrogen Energy

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Awards & Achievements

- Postdoctoral Research Grant from University of Porto, Portugal (Sep 2020–Sep 2021)
- International Research Support Initiative program Scholarship from Higher Education Commission of Pakistan (Feb 2015)
- In-House PhD Scholarship from COMSATS University Islamabad (Feb 2012 - Jan 2016)
- Merit MS Scholarship from Center of Advanced Studies in Engineering, University of Engineering and Technology Taxila (2009–2011)
- Recipient of Research Productivity Award from COMSATS University Islamabad (2014 and 2015)
- Recipient of MS and PhD scholarships from UCG Project Thar (2010–2013)

Extracurricular Activities

- Travelling
- Playing cricket, tennis and badminton
- Consecutive winner of COMSATS faculty badminton tournament (singles and doubles) from 2014–2019
- Winner of badminton tournament (singles and doubles) held at The Shalimar Club Rawalpindi, 2019
- Represented University of Engineering and Technology Taxila in inter-universities cricket tournament held at the University of Punjab, 2005

Referees

Name	Dr. Aamer Iqbal Bhatti
Position	Professor
Affiliation	University of Engineering and Technology, Lahore, Pakistan
Phone	+92300 8568722

Name	Dr. Jamshed Iqbal
Position	Senior Lecturer
Affiliation	University of Hull, Hull, UK
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Name	Dr. Qadeer Ahmed
Position	Assistant Professor
Affiliation	The Ohio State University, Columbus, OH, USA
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Name	Dr. Fernando A.C.C. Fontes
Position	Associate Professor
Affiliation	University of Porto, Porto, Portugal
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