

Ali Arshad Uppal, Ph.D., SMIEEE

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Research Interests

• Nonlinear control • Optimal control • Data driven control • Control of energy conversion systems




Professional Experience

- 2023 –  **Tenured Associate Professor**, Department of Electrical & Computer Engineering, COMSATS University Islamabad (CUI), Islamabad, Pakistan
- Teaching at graduate & undergraduate levels
 - Supervision/Co-supervision of MS and Ph.D. theses and undergraduate projects
 - Head of Control and Energy Systems Research group
- 2014 – 2023  **Assistant Professor**, Department of Electrical & Computer Engineering, CUI
- Teaching at graduate & undergraduate levels
 - Supervision/Co-supervision of MS and Ph.D. theses and undergraduate projects
 - Head of Control and Energy Systems Research group
- 2020 – 2021  **Doctoral Researcher**, Department of Electrical & Computer Engineering, University of Porto, Porto, Portugal
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
- 2015 – 2016  **Visiting Scholar**, Department of Electrical & Computer Engineering, The Ohio State University, Columbus, OH, USA
- Development of a simplified time domain model of underground coal gaisification (UCG) process
 - Development of the model based control of the UCG 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
- 2012 – 2014  **Professional Researcher**, Control & Signal Processing Research Group, Capital University of Science & technology, Islamabad, Pakistan
Research Project: *ICT R & D Funds– Simulation and Control of the UCG process*
- Development of the one-dimensional packed bed reactor model for Thar 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

Professional Experience (continued)









- 2008 – 2012  **Lecturer**, Department of Electrical & Computer Engineering, CUI
- Teaching at undergraduate level
 - Supervision of undergraduate projects
 - Designed and conducted labs for Electric Machines and Control System
- 2007 – 2008  **Design Engineer**, Public Sector Organization, Islamabad, Pakistan
- Integration and testing of electronic modules

















Education







- 2012 – 2016  **Ph.D., Electrical Engineering, COMSATS University Islamabad.**
Thesis title: [Modeling and Control of Underground Coal Gasification](#).
- 2009 – 2011  **M.Sc., Computer Engineering, University of Engineering & Technology Taxila.**
Thesis title: Dynamic Modeling and Nonlinear Controller Design for UCG.
- 2003 – 2006  **BS., Electrical Engineering, University of Engineering & Technology Taxila.**

Publications






Journal Articles

- 1 **A. A. Uppal**, S. B. Javed, and Q. Ahmed, "Power losses aware nonlinear model predictive control design for active cell balancing," *IEEE Control Systems Letters (accepted for publication)*, 2024.
- 2 S. Ahmad, **A. A. Uppal**, M. R. Azam, and J. Iqbal, "Chattering free sliding mode control and state dependent kalman filter design for underground gasification energy conversion process," *Electronics*, vol. 12, no. 4, Feb. 2023, ISSN: 2079-9292.  DOI: [10.3390/electronics12040876](https://doi.org/10.3390/electronics12040876).
- 3 A. Ahmed, S. B. Javed, **A. A. Uppal**, and J. Iqbal, "Development of cavlab—a control-oriented matlab based simulator for an underground coal gasification process," *Mathematics*, vol. 11, no. 11, May 2023, ISSN: 2227-7390.  DOI: [10.3390/math11112493](https://doi.org/10.3390/math11112493).
- 4 A. Ahmed, **A. A. Uppal**, and S. B. Javed, "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, p. 103 090, Nov. 2023, ISSN: 0959-1524.  DOI: [10.1016/j.jprocont.2023.103090](https://doi.org/10.1016/j.jprocont.2023.103090).
- 5 U. Javaid, A. Mehmood, J. Iqbal, and **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, p. 126 717, 2023, ISSN: 0360-5442.  DOI: <https://doi.org/10.1016/j.energy.2023.126717>.
- 6 **A. A. Uppal**, M. R. Azam, and J. Iqbal, "Sliding mode control in dynamic systems," *Electronics*, vol. 12, no. 13, Jul. 2023.  DOI: [10.3390/electronics12132970](https://doi.org/10.3390/electronics12132970).
- 7 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, p. 110 914, 2022, ISSN: 0022-5193.  DOI: <https://doi.org/10.1016/j.jtbi.2021.110914>.
- 8 U. Javaid, J. Iqbal, A. Mehmood, and **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, pp. 1–20, Feb. 2022.  DOI: [10.1371/journal.pone.0264205](https://doi.org/10.1371/journal.pone.0264205).
- 9 S. B. Javed, V. I. Utkin, **A. A. Uppal**, R. Samar, and A. I. Bhatti, "Data-driven modeling and design of multivariable dynamic sliding mode control for the underground coal gasification project thar," *IEEE Transactions on Control Systems Technology*, vol. 30, no. 1, pp. 153–165, 2022.  DOI: [10.1109/TCST.2021.3057633](https://doi.org/10.1109/TCST.2021.3057633).

- 10 M. Khattak, A. A. Uppal, Q. Khan, *et al.*, “Neuro-adaptive sliding mode control for underground coal gasification energy conversion process,” *International Journal of Control*, vol. 95, no. 9, pp. 2337–2348, 2022.  DOI: [10.1080/00207179.2021.1909745](https://doi.org/10.1080/00207179.2021.1909745).
- 11 H. Muazzam, M. K. Ishak, A. Hanif, A. A. Uppal, A. 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: [10.3390/en15051773](https://doi.org/10.3390/en15051773).
- 12 I. U. Rehman, S. B. Javed, A. M. Chaudhry, M. R. Azam, and 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, ISSN: 0959-1524.  DOI: <https://doi.org/10.1016/j.jprocont.2022.06.006>.
- 13 Y. M. Alsmadi, I. U. Rehman, A. A. Uppal, V. Utkin, I. Chairez, and M. Ibbini, “Super-twisting-based sliding mode control of drum boiler energy conversion systems,” *International Journal of Control*, vol. 95, no. 7, pp. 1888–1897, 2021.  DOI: [10.1080/00207179.2021.1884293](https://doi.org/10.1080/00207179.2021.1884293).
- 14 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. 130 737–130 750, 2021.  DOI: [10.1109/ACCESS.2021.3114260](https://doi.org/10.1109/ACCESS.2021.3114260).
- 15 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, p. 119 000, 2021, ISSN: 0360-5442.  DOI: <https://doi.org/10.1016/j.energy.2020.119000>.
- 16 A. Mohsin, Y. 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, p. 00 368 504 211 025 409, 2021.  DOI: [10.1177/00368504211025409](https://doi.org/10.1177/00368504211025409).
- 17 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, p. 00 368 504 211 044 848, 2021.  DOI: [10.1177/00368504211044848](https://doi.org/10.1177/00368504211044848).
- 18 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. 24, 2021, ISSN: 1996-1073.  DOI: [10.3390/en14248337](https://doi.org/10.3390/en14248337).
- 19 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: [10.1080/00207179.2018.1516893](https://doi.org/10.1080/00207179.2018.1516893).
- 20 M. Ilyas, J. Iqbal, S. Ahmad, A. A. Uppal, W. A. Imtiaz, and R. A. Riaz, “Hypnosis regulation in propofol anaesthesia employing super-twisting sliding mode control to compensate variability dynamics,” *IET Systems Biology*, vol. 14, no. 2, pp. 59–67, 2020.  DOI: <https://doi.org/10.1049/iet-syb.2018.5080>.
- 21 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. 223 130–223 139, 2020.  DOI: [10.1109/ACCESS.2020.3044194](https://doi.org/10.1109/ACCESS.2020.3044194).
- 22 U. Javaid, A. Mehmood, A. Arshad, F. Imtiaz, and J. Iqbal, “Operational efficiency improvement of pem fuel cell—a sliding mode based modern control approach,” *IEEE Access*, vol. 8, pp. 95 823–95 831, 2020.  DOI: [10.1109/ACCESS.2020.2995895](https://doi.org/10.1109/ACCESS.2020.2995895).
- 23 Y. M. Alsmadi, A. M. Abdel-hamed, A. E. Ellissy, *et al.*, “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, ISSN: 0016-0032.  DOI: <https://doi.org/10.1016/j.jfranklin.2018.12.014>.
- 24 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, ISSN: 0360-5442.  DOI: <https://doi.org/10.1016/j.energy.2019.02.005>.
- 25 M. Rizwan Azam, V. I. Utkin, A. Arshad Uppal, and A. I. Bhatti, “Sliding mode controller–observer pair for p53 pathway,” *IET Systems Biology*, vol. 13, no. 4, pp. 204–211, 2019.  DOI: <https://doi.org/10.1049/iet-syb.2018.5121>.

- 26 A. A. Uppal, S. S. Butt, Q. Khan, and 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, ISSN: 0959-1524.  DOI: <https://doi.org/10.1016/j.jprocont.2018.11.005>.
- 27 A. R. Yasin, M. Ashraf, A. I. Bhatti, and A. A. Uppal, "Fixed frequency sliding mode control of renewable energy resources in dc micro grid," *Asian Journal of Control*, vol. 21, no. 4, pp. 2074–2086, 2019.  DOI: <https://doi.org/10.1002/asjc.2057>.
- 28 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, 2018.  DOI: [10.1109/TCST.2017.2692718](https://doi.org/10.1109/TCST.2017.2692718).
- 29 I. Khan, A. I. Bhatti, A. A. Uppal, and Q. Khan, "Robustness and performance parameterization of smooth second order sliding mode control," *International Journal of Control, Automation and Systems*, vol. 14, no. 3, pp. 681–690, Jun. 2016, ISSN: 2005-4092.  DOI: [10.1007/s12555-014-0181-6](https://doi.org/10.1007/s12555-014-0181-6).
- 30 A. A. Uppal, A. I. Bhatti, E. Aamir, 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, 2015, ISSN: 0959-1524.  DOI: <https://doi.org/10.1016/j.jprocont.2015.08.002>.
- 31 A. A. Uppal, A. I. Bhatti, E. Aamir, R. Samar, and S. A. Khan, "Control oriented modeling and optimization of one dimensional packed bed model of underground coal gasification," *Journal of Process Control*, vol. 24, no. 1, pp. 269–277, 2014, ISSN: 0959-1524.  DOI: <https://doi.org/10.1016/j.jprocont.2013.12.001>.

Conference Proceedings

- 1 S. B. Javed, A. A. Uppal, M. R. Azam, K. Shehzad, and Q. Ahmed, "Model-based quantitative analysis of a capacitive cell balancing technique using soc estimator," in *2022 IEEE Conference on Control Technology and Applications (CCTA)*, 2022, pp. 670–675.  DOI: [10.1109/CCTA49430.2022.9966110](https://doi.org/10.1109/CCTA49430.2022.9966110).
- 2 A. A. Uppal, S. S. Butt, A. I. Bhatti, and H. Aschemann, "Integral sliding mode control and gain-scheduled modified utkin observer for an underground coal gasification energy conversion process," in *2018 23rd International Conference on Methods and Models in Automation and Robotics (MMAR)*, 2018, pp. 357–362.  DOI: [10.1109/MMAR.2018.8486053](https://doi.org/10.1109/MMAR.2018.8486053).
- 3 "Nonlinear robust control of atkinson cycle engine," in *20th IFAC World Congress*, 2017, pp. 3685–3690.  DOI: <https://doi.org/10.1016/j.ifacol.2017.08.562>.
- 4 M. Azam, A. Bhatti, A. Arshad, and M. Babar, "Sensitivity analysis of wnt signaling pathway," in *Proceedings of 2013 10th International Bhurban Conference on Applied Sciences & Technology (IBCAST)*, 2013, pp. 122–127.  DOI: [10.1109/IBCAST.2013.6512143](https://doi.org/10.1109/IBCAST.2013.6512143).
- 5 A. Arshad, 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*, 2012, pp. 1–6.  DOI: [10.1109/ICET.2012.6375477](https://doi.org/10.1109/ICET.2012.6375477).

Funded Projects

- **Machine Learning Based System Identification and Control of Complex Physical Systems**
Submitted in *Google Research Scholar Awards 2023*

Student Supervision

MS Students

1. Mr. Imran Ahmed, COMSATS University Islamabad (2021–2023)
Supervisor: Dr. Rizwan Azam, co-supervisor: **Dr. Ali Arshad Uppal**
2. Mr. Afaq Ahmed, COMSATS University Islamabad (2021–2023)
Supervisor: **Dr. Ali Arshad Uppal** co-supervisor: Dr. Syed Bilal Javed
3. Mr. Owais Shaukat, COMSATS University Islamabad (2021–present)
supervisor: **Dr. Ali Arshad Uppal**
4. Ms. Sara Sarfraz, COMSATS University Islamabad (2019–2021)
Supervisor: **Dr. Ali Arshad Uppal**, co-supervisor: Dr. Qudrat Khan
5. Ms. Shehar Bano, COMSATS University Islamabad (2018–2020)
supervisor: **Dr. Ali Arshad Uppal**, co-supervisor: Dr. Rizwan Azam
6. Ms. Fajar Mukhtar, COMSATS University Islamabad (2018–2020)
supervisor: **Dr. Ali Arshad Uppal**, co-supervisor: Dr. Syed Bilal Javed
7. Mr. Sohail Ahmed, COMSATS University Islamabad (2018–2020)
Supervisor: **Dr. Ali Arshad Uppal**
8. Mr. Bilal Arif, COMSATS University Islamabad (2018–2020)
Supervisor: prof. Shahid A. Khan, co-supervisor: **Dr. Ali Arshad Uppal**
9. Mr. Mutahir, COMSATS University Islamabad (2016–2018)
supervisor: prof. Shahid A. Khan, co-supervisor: **Dr. Ali Arshad Uppal**
10. Mr. Imtiaz Ur Rehman, COMSATS University Islamabad (2016–2018)
Supervisor: prof. Shahid A. Khan, co-supervisor: **Dr. Ali Arshad Uppal**
11. Mr. Fahad Imtiaz, COMSATS University Islamabad (2014–2016)
Supervisor: Dr. Adeel Mehmood, co-supervisor: **Dr. Ali Arshad Uppal**

Ph.D. students

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

Teaching Experience

■ Graduate courses at COMSATS University Islamabad

- Intelligent Control Systems (ECI761) in Spring 2022
- Nonlinear Systems and Controls (ECI760) in Fall 2021 and Fall 2022
- Linear Control Systems (ECI660) in Fall 2019
- Linear Systems Theory (ECI665) in Spring (2017, 2018 and 2019) and Fall 2017
- Robust Control Systems (ECI765) in Fall 2018

■ Undergraduate courses at COMSATS University Islamabad

- Control Systems (EEE325, CPE325) in Fall 2023, Spring 2023, and from 2011–2021
- Electric Machines (EEE371) in Spring 2023, and from 2008–2011
- Electronics-I (EEE231) in Fall 2022

Presentations & Workshops

■ Presentations

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

■ Workshops

1. **L^AT_EX–The Way of Scientific Writing**, at the department of Electrical and Computer Engineering, COMSATS University Islamabad on 17 October 2022
2. **Typesetting in L^AT_EX**, at Capital University of Science & Technology, Islamabad on March 13 2018, July 17 2019 and August 5 2021, respectively

Computer Skills

- | | | |
|-------------------|-----------------------------------|-------------|
| • MATLAB/Simulink | • C++ | • Maple |
| • Mathematica | • L ^A T _E X | • MS Office |

Awards & Achievements

- | | |
|-----------|--|
| 2022 | ■ Senior Member IEEE |
| 2020–2021 | ■ Postdoctoral Scholarship from FEUP, University of Porto, Portugal |

Awards & Achievements (continued)

2015	■ International Research Support Initiative Program Scholarship from higher education commission, Pakistan
2014–2015	■ Research Productivity Award from COMSATS University Islamabad
2012–2013	■ Ph.D. Scholarship from UCG project Thar, Pakistan
2012–2016	■ In-house Ph.D. Scholarship from COMSATS University Islamabad, Pakistan
2010–2011	■ MS Scholarship from UCG project Thar, Pakistan
	■ Merit MS Scholarship from Center of Advanced Studies in Engineering, University of Engineering & Technology, Taxila, Pakistan

Community Services

2022–2023	■ Guest Editor in the special issue <i>Sliding Model Control in Dynamic Systems</i> , MDPI Electronics.
2016– . . .	■ Academic Reviewer for the Journal of process control, IEEE Control Systems Letters, IEEE Transactions on (Industrial Informatics, Mechatronics, Transportation & Electrification), International Journal of Hydrogen Energy, Energy Conversion and Management, American Control Conference, IEEE Access, and various journals of MDPI.

References

Name Dr. Aamer Iqbal Bhatti
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Name Dr. Jamshed Iqbal
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Name Dr. Qadeer Ahmed
Position Assistant Professor
Affiliation The Ohio State University, Columbus, OH, USA
Email ahmed.358@osu.edu

Name Dr. Fernando Fontes
Position Associate Professor
Affiliation University of Porto, Portugal
Email faf@fe.up.pt