



SCES-2027

9th Students' Conference on Engineering and Systems 2027

12 March - 14 March, 2026, Prayagraj, Uttar Pradesh, INDIA

Special Session/Track Proposal

Title of the Proposal: AI and Digital Twins for Next-Generation Power System Monitoring, Control and Optimization with Renewable Energy Penetration

A Brief Description of the Area of Concern (With significance):

Description and significance: The proposed area focuses on the integration of advanced Artificial Intelligence (AI), machine learning, and digital twin technologies to develop intelligent, adaptive, and resilient power and energy systems. The rapid integration of renewable energy sources, distributed energy resources, electric vehicles, energy storage systems, and flexible loads has significantly increased the complexity and uncertainty of modern power grids. Conventional monitoring, control, and optimization techniques may face challenges in managing these highly dynamic and interconnected systems. The area is significant because it can enable data-driven, predictive, autonomous, and resilient power-system operation while improving reliability, efficiency, flexibility, and renewable-energy utilization. AI-enabled digital twins can also facilitate real-time testing of control strategies before their deployment in physical systems, thereby reducing operational risks and costs. The proposed area, therefore, provides an interdisciplinary platform connecting AI, digitalization, power-system control, optimization, renewable integration, energy storage, microgrids, EVs, and grid resilience, supporting the development of intelligent and sustainable next-generation energy infrastructure.

Details of Session Chairs/Organizers (Short CV attached):

Organizers: **Organizer 1:**

Name: Dr. Maneesh Kumar
Designation: Assistant Professor
Department: Department of Electrical Engineering
Institute: NIT Kurukshetra, Haryana
Email ID: maneesh.k@nitkr.ac.in

Organizer 2:

Name: Dr. Sachidananda Sen
Designation: Associate Professor
Department: Electrical and Electronics Engineering
Institute: SR University, Telangana
Email ID: s.sachidananda@sru.edu.in

Technical Outline of the Session and Topics:

Outline of the Session:

Proposed Session Outline

1. AI for Renewable-Dominated Power System Monitoring

- AI/ML-based power-system state estimation
- Wide-area monitoring and situational awareness
- PMU and smart-meter data analytics

- AI-based anomaly and event detection
- Fault classification and diagnosis
- Data-driven voltage and frequency monitoring

2. Digital Twins for Power and Energy Systems

- Digital-twin architectures for power grids
- Component-, microgrid-, and system-level digital twins
- Real-time synchronization between physical and virtual systems
- Digital twins for PV, wind, BESS, EVs, and hybrid energy systems
- Model updating and parameter identification
- What-if and contingency analysis

3. AI-Based Renewable Energy Forecasting

- Solar and wind power forecasting
- Deep learning and hybrid AI models
- Probabilistic and uncertainty-aware forecasting
- Extreme-weather and renewable variability prediction
- Forecasting for real-time energy management

4. AI-Driven Power System Optimization

- AI-assisted optimal power flow
- Security-constrained optimization
- Unit commitment and economic dispatch
- Multi-objective optimization
- AI combined with mathematical optimization
- Reinforcement learning for power-system decision-making

5. Intelligent Control of Renewable-Dominated Grids

- AI-based voltage and frequency control
- Adaptive and predictive control
- Reinforcement-learning-based control
- Grid-forming/grid-following inverter control
- Coordinated control of distributed energy resources
- AI-enabled microgrid control

6. AI-Enabled Energy Management Systems

- Intelligent EMS for high renewable energy integrated microgrids
- Coordinated PV-BESS operation
- Renewable-battery-hydrogen energy management
- Demand response and flexible loads
- EV charging and vehicle-to-grid (V2G)
- Multi-energy system optimization

7. Digital Twins + AI for Predictive Maintenance and Resilience

- AI-based condition monitoring
- Predictive maintenance of grid assets
- Fault prediction and early warning
- Resilience assessment under extreme events
- Self-healing and adaptive power systems
- Cyber-physical resilience

8. Real-Time and Hardware-in-the-Loop Implementation

- Real-time digital twins
- Controller-HIL and Power-HIL
- Real-time AI inference
- Edge AI for power-system applications
- Digital-twin-based testing and validation
- Deployment on embedded/edge computing platforms

Tentative Topics of the Session (but not limited to):

- 1. AI for Renewable-Dominated Power System Monitoring**
- 2. Digital Twins for Power and Energy Systems**
- 3. AI-Based Renewable Energy Forecasting**
- 4. AI-Driven Power System Optimization**
- 5. Intelligent Control of Renewable-Dominated Grids**
- 6. AI-Enabled Energy Management Systems**
- 7. Digital Twins + AI for Predictive Maintenance and Resilience**
- 8. Real-Time and Hardware-in-the-Loop Implementation**
- 9. Trustworthy and Explainable AI for Power Systems**

Potential Reviewers (names, affiliations and emails, at lease 20):

1. Dr. Arnab Ghosh, Assistant Professor, NIT Raurkella, India
2. Dr. Provas Kumar Roy, Professor, Kalyani Govt. Engineering College, WB, India.
3. Dr. Subrata Banerjee, Professor, National Institute of Technology, Durgapur, India
4. Dr. Lalit Chandra Saikia, Associate Professor, NIT Silchar, India
5. Dr. Sandeep Dhundhara, Assistant Professor, CCS Haryana Agricultural University, Hisar, Haryana, India
6. Dr. Md. Mujahid Irfan, SR University, Warangal, India
7. Dr. Ramesh C. Bansal, University of Sharjah, United Arab Emirates
8. Dr. Khalifa Al Hosani, Associate Professor, Khalifa University, UAE
9. Dr. Ch. Hussaian Basha, SR University, Warangal, India
10. Dr. Haluk Gözde, Turkish Aerospace Industry, Ankara, Turkey
11. Dr. Peddakapu Purukuri, Universiti Malaysia, Pahang
12. Dr. Hareesh Kumar Shabhadia, WSP, United Kingdom
13. Dr. Amit Kumar Thakur, General Electric, Noida, India
14. Dr. Jagannath Samantaray, Mathworks, India
15. Dr. Chandan Kumar Shiva, SR University, Warangal, India
16. Dr. Dharmendra Yadeo, Transportation Specialist, Tata Elxsi, Pune, India
17. Dr. P. R. Kumar, Texas A&M University, USA
18. Dr. Abhishek Dhar, Linköping University, Sweden.
19. Dr. Saran Satsangi, NIT Patna
20. Dr. Pushkar Arya, NIT Patna
21. Dr. Om Hari Gupta, NIT Jamshedpur
22. Dr. Abdul Haleem, R&D Center-DEWA, Dubai, UAE.
23. Dr. Anil Yadav, National Institute of Technology Jalandhar
24. Dr. Rudranarayan Pradhan, Odisha University of Technology and Research, Bhubaneswar
25. Dr. Subhodip Saha Punjab Engineering College (Deemed to be University),
26. Dr. Sheila Mahapatra Alliance University, Bangalore, India
27. Dr. VVSN Murty, National Institute of Technology, Kurukshetra
28. Dr. Harimurugan, National Institute of Technology Jalandhar
29. Dr. B Rao, National Institute of Technology Jalandhar
30. Dr. Gagandeep Singh, National Institute of Technology Jalandhar
31. Dr. Kesava Rao, Hitachi Energy

Expected Number of Submissions:

40-50

Other Details (if any):

Brief CVs:

Session Chair 1: Dr. Maneesh Kumar



Dr. Maneesh Kumar received his Ph.D. in Power Systems domain from the Department of Electrical Engineering, Indian Institute of Technology Roorkee (IIT Roorkee), India, in 2021. His research interests encompass hybrid microgrids, renewable energy integration in grids, power system optimization, adaptive voltage control, and green hydrogen production. He has also contributed to multidisciplinary research projects funded by the Department of Science and Technology (DST), the Central Power Research Institute (CPRI) of the Govt. of India, and international organizations, including the University of Colorado Boulder, USA and New Venture Funds, Washington, D.C. during his tenure as a Postdoctoral Fellow in the Department of Hydro and Renewable Energy at IIT Roorkee. Dr. Kumar has authored and co-authored research papers in reputed national and international journals and conferences published by leading publishers, including IEEE, IET, Springer, Elsevier, Taylor and Francis, and SAGE. He is a Senior Member of IEEE and a Life Member of ISTE. He is currently an Assistant Professor in the Department of Electrical Engineering at NIT Kurukshetra, Haryana, India.

Session Chair 2: Dr. Sachidananda Sen



Dr. Sachidananda Sen completed his B.Tech in Electrical and Electronics Engineering from GITA, Bhubaneswar in 2011. He worked in Industry for a year then went for Master's in Engineering (ME) in Control Systems specialization from Indian Institute of Engineering Science and Technology (IIEST), Shibpur, Kolkata in 2015 and completed Ph.D. from Indian Institute of Technology (IIT) Roorkee in Electrical Engineering in 2020. He is currently working as Associate Professor in the Department of Electrical and Electronics Engineering at SR University, Warangal and also holds the post of Associate Dean, D.Sc. Program.

His research interests include Microgrids, Control systems design, Electric vehicles, Smart grid, and Sustainable development. He has published more than 120 International Journals, Book chapters, and Conferences. And he is an active reviewer for many reputed international journals and chaired several technical sessions for International Conferences.