SOUMYABRATA TALUKDER

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CAREER OBJECTIVE

A dedicated, self-propelled and goal-oriented **Ph.D. student majoring in Electrical Engineering, with more than 8 years of past professional experience in project management and leadership** in the energy and infrastructure sectors, intrigued towards **machine-learning, data-analytics, control, optimization and formal methods** with **power systems** as the current application domain.

EDUCATION

Iowa State University, IA, USA *Aug 2017 - present*
Doctor of Philosophy (in progress) CGPA: 4.00/4.00
Department of Electrical and Computer Engineering

Jadavpur University, Kolkata, India *Jun 2005 - Apr 2009*
Bachelor of Engineering (2^{nd} ranker, 1^{st} class with honors) CGPA: 9.08/10.00
Department of Electrical Engineering

GRADUATE COURSES TAKEN

EE-552*	Energy System Planning	**EE-653***	Advanced Topics in Power System
EE-554	Power System Dynamics	**EE-576**	Digital Feedback Control
EE-525X	Data Analytics	**EE-526X**	Deep Learning
ME-592X	Machine Learning for CPS	**EE-571**	Convex Optimization
STAT-554	Stochastic Processes	**EE-577**	Linear Systems
EE-578	Nonlinear Systems	**COMS-507X**	Applied Formal Methods

* in progress as of Spring '21

ACCEPTED/SUBMITTED RESEARCH PUBLICATIONS

1. **S. Talukder**, R. Kumar, *An Enhancement in Sum-of-Squares Optimization based Region of Attraction Estimation for Power Systems* - accepted in IEEE PES General Meeting 2019 (link).

2. **S. Talukder**, M. Ibrahim, R. Kumar, *Resilience Indices for Power/Cyberphysical Systems* - accepted in IEEE Transactions on Systems, Man and Cybernetics: Systems in Sep 2020 (link).

3. **S. Talukder**, S. Liu, H. Wang, G. Zheng *Low-frequency Forced Oscillation Source Location - A Deep Learning Approach* - submitted in IEEE PES General Meeting 2021.

4. **S. Talukder**, R. Kumar, *Online Early Prediction of Long-term Voltage Instability using Deep Learning* - submitted in IEEE PES General Meeting 2021.

ACADEMIC RESEARCH EXPERIENCE

Iowa State University, IA, USA *Fall 2018 - present*
Research assistant at ESSeNCE lab, supervised by Dr. Ratnesh Kumar

- **Stability Guaranteed Deep Reinforcement-learning** (current research area): Guaranteeing dynamic stability of nonlinear plants controlled by modern Deep Reinforcement-Learning (DRL) agents is an open problem, posing a hurdle in safety/time-critical applications. I am currently analyzing closed-loop stability of such systems computing a Lyapunov function, which is robust to bounded shift of operating equilibrium caused by structural perturbation of the plant.

- **Power Systems Anomaly Detection using Deep Neural-networks**: A *long-short-term-memory* (LSTM)-based deep-neural-network (DNN) is proposed for early prediction of *long-term voltage instability*, which may ensue a large disturbance in a bulk power-grid. The proposed DNN is capable to utilize both the pre-fault SCADA snapshot and a short-prefix of the post-fault time-series of PMU measurements for prediction, showing substantial noise-robustness.
- **Sum-of-squares Optimization**: An algorithmic enhancement of the traditional *sum-of-squares optimization* based *region-of-attraction* (ROA) estimation for bulk power systems is proposed, reducing the overall computation time. The ROA is estimated as a sub-level set of a *Lyapunov* function, which provides a metric to quantify the transient stability of a power system.
- **Resilience Quantification**: A physical-topology-guided notion of resilience for power systems is introduced, and is quantified as a six dimensional unit-interval normalized vector. A new way of computing *transient stability margin* and *critical clearance time* using sum-of-squares optimization is proposed. Also, an efficient method to compute *relay margin* by solving an iterative *quadratic-constraint-quadratic-program* is introduced.

SKILLS

Research	Transient stability and voltage stability of power-grid, steady-state and dynamic performance analysis, robust stability, model-predictive control, data analytics, machine-learning, large-scale coalition games, resilience of complex systems, semidefinite programming, polynomial optimization, formal methods.
Technical software	PSS/E, DSATools, PSLF, PSCAD, PSAT, Tensor Flow, PyTorch, Scikit-learn, CVX, Julia, SQL, Nuxmv, Spin, Z3, AADL.
General tool	MS Office, MS Project, MS Visio, Latex.
Programming language	Python, Matlab, Java, C, C++, Fortran.
Operating system	Linux (both Fedora and Debian distributions), Windows.
Managerial	Managing scope, time, cost and quality of projects, leadership, stakeholder management, progress monitoring and reporting.

INDUSTRIAL EXPERIENCE

GE Research, NY, USA *Sep 2020 - Dec 2020*
Fellow Intern

- Worked with the Software & Analytics team in collaboration with the WAMS team of GE Digital to formulate and solve the low-frequency oscillation source location problem of bulk power systems using Deep Learning, where the input is 3D spectral features extracted from simulated PMU data. Effectiveness and robustness of the method are demonstrated on IEEE 68-bus and WECC 179-bus test systems.
- Submitted an article on IEEE PES General Meeting 2021 reporting a part of the research finding.

GE Research, NY, USA *May 2019 - Aug 2019*
Fellow Intern

- Worked with the formal methods team for the **Cyber Assured System Engineering** (CASE) project, led by DARPA. Proposed and developed an innovative graphical user interface that provides an intuitive and interactive *wizard* to set the mission-level cyber requirements as well as the cyber relations among the inter-dependent subcomponents involved in the mission.
- Got exposed to GE's Bayesian Hybrid Modelling tool, which uses a Gaussian process based learning technique for modeling and testing of dynamic input-output systems.

ITC Ltd., Bangalore, India *Dec 2012 - Jul 2017*
Assistant Manager - Projects

- Led design, procurement and construction of electro-mechanical services for two large-scale building projects including **high/medium voltage power distribution, solar PV integration, building management system** etc. The projects are IGBC LEED certified and the site spans over 9 acres of plot area and 0.6 million sqft. of built-up space.
- Took the role of a key coordinator among the interdependent disciplines (e.g. structural, interior, electro-mechanical etc.) of the overall project.
- Actively participated in the procurement process including tender preparation, finalization, bid evaluation and getting suppliers, contractors and consultants on-board.
- Other responsibilities included scheduling of overall project (including engineering, procurement, construction and handing over), resource and cash-flow planning, monitoring scope, time, budget and quality, periodic reporting to the management, risk analysis and management, site construction monitoring and contractor management, conflict resolution and stake-holder management.
- Supervised a team of six engineers who were responsible for electrical and mechanical and related works.

GE Grid Solutions, Noida, India (earlier Alstom Grid) *Jul 2009 - Nov 2012*
Project Engineer

- Led site installation and commissioning of *electrical balance of plant* for a 2 x 600 MW thermal power plant, together with a **400 kV generation switchyard including protection systems, SCADA, DCS and station auxiliary distribution**.
- Led engineering, procurement and construction of **6 new extra-high-voltage transmission substation** projects.
- Responsibilities included scheduling of overall project (including engineering, procurement, construction and handing over), resource, sales and cash-flow planning, monitoring scope, time, budget and quality, periodic reporting to the management, risk analysis and management, leading coordination among in-house engineering, procurement and construction teams, site construction monitoring and sub-contractor management, stake-holder management.

CERTIFICATIONS

- *SQL for Data Science* by University of California, Davis through Coursera (link)
- *Advanced Relational Database and SQL* by Coursera Project Network through Coursera (link)

TEACHING EXPERIENCE

Iowa State University, IA, USA *Fall 2017 - Spr 2018*
Teaching assistant for EE-324 (Signals and Systems - II)

- Responsibilities included course-recitation, lab-proctoring and grading.

AWARDS AND ACCOLADES

1. Received **Impact Award** from General Electric Global Research Center, USA, in Jul 2019 for developing an innovative graphical user-interface that made usage of a software toolset substantially easier.
2. Received **Certificate of Appreciation** from the CEO of ABD, ITC Limited, India, in Jun 2017 for timely delivery of a constrained project.

3. Received **Barindra Memorial Medal** from Jadavpur University, India, in Dec 2009 for distinguished academic performance in **Power System Design and Planning** during Bachelor of Engineering program.
4. Received **SEEA scholarship** from West Bengal State Electrical Engineers Association, India, in Aug 2008 for consistent academic excellence during Bachelor of Engineering program.
5. Received **National Merit Scholarship** from Govt. of India in Aug 2005 for academic distinction prior undergraduate program.

EXTRA-CURRICULAR ACTIVITY

Voluntary promoter of sustainability and optimal usage of natural resources. A **certified trainer** of **Green Rating for Integrated Habitat Assessment (GRIHA)**.