

# SOUMYABRATA TALUKDER

Ph: (+1) 515-290-2044 ◇ Email: [talukder@iastate.edu](mailto:talukder@iastate.edu) ◇ Website: [talukder88.github.io](http://talukder88.github.io)

## CAREER OBJECTIVE

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A dedicated, self-motivated and spontaneous **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 and inclined towards the areas of **machine-learning, data-analytics, numerical optimization and formal methods** with power systems and energy market as the current application domain.

## EDUCATION

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**Iowa State University, IA, USA**

Doctor of Philosophy (in progress)

Department of Electrical and Computer Engineering

*Aug 2017 - present*

CGPA: 4.00/4.00

**Jadavpur University, Kolkata, India**

Bachelor of Engineering (2<sup>nd</sup> ranker, 1<sup>st</sup> class with honors)

Department of Electrical Engineering

*Jun 2005 - Apr 2009*

CGPA: 9.08/10.00

## GRADUATE COURSES TAKEN

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<b>EE-525X</b>	Data Analytics	<b>EE-526X</b>	Deep Learning
<b>ME-592X</b>	Machine Learning for CPS	<b>EE-571</b>	Convex Optimization
<b>STAT-554</b>	Stochastic Processes	<b>EE-577</b>	Linear Systems
<b>EE-576</b>	Digital Feedback Control	<b>EE-578</b>	Nonlinear Systems
<b>EE-554</b>	Power System Dynamics	<b>COMS-507X</b>	Applied Formal Methods

## ACCEPTED/SUBMITTED RESEARCH PUBLICATIONS

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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 ([link](#)).
3. **S. Talukder**, R. Kumar, *Online Early Prediction of Long-term Voltage Instability using a Hybrid Deep Neural Network* - submitted in IEEE Electric Power and Energy Conference 2020 ([link](#)).

## SKILLS

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<b>Research</b>	Big-data analytics and machine-learning for power systems, Large-scale coalition games for energy-storages, Resilience of complex systems, Semidefinite programming, Polynomial optimization, Steady-state and dynamic analysis of power-grid.
<b>Technical software</b>	Tensor Flow, PyTorch, Keras, Scikit-learn, SQL, R, MATLAB, Nuxmv, Spin, Z3, AADL, PSSE, PSLF, PSCAD, PSAT.
<b>General tool</b>	MS Office, MS Project, MS Visio, Latex.
<b>Programming language</b>	Python, Java, C, C++.
<b>Operating system</b>	Linux (both Fedora and Debian distributions), Windows.
<b>Managerial</b>	Managing scope, time, cost and quality of projects, leadership, stakeholder management, progress monitoring and reporting.

## ACADEMIC RESEARCH EXPERIENCE

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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): Recently, the wide-area control schemes are shown to be more effective than their decentralized counterparts, under emergency condition of a large power-grid. However, computing real-time centralized stabilizing control utilizing the wide-area measurements using the conventional optimization-based techniques may not be practical due to their computational complexity, especially when the control needs to enact within a very short duration. This motivates us to explore the possibility to design a deep-reinforcement learning based centralized controller that can also guarantee stability.
- **Power Systems Anomaly Detection using Deep Neural-networks:** A novel *long-short-term-memory* (LSTM) based deep-neural-network (DNN) is proposed for early prediction of *long-term voltage instability*, ensuing a large disturbance in a 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 improvement in its noise-robustness over the state-of-the-art.
- **Sum-of-squares Optimization:** An algorithmic enhancement of the traditional *sum-of-squares optimization* based *region-of-attraction* (ROA) estimation for power systems is proposed, showing significant reduction in the overall computation time. The approach is further extended to compute the volume of the estimated ROA as a sub-level set of a *Lyapunov* function, which provides a metric to quantify the transient stability of a power system in polynomial time computational complexity.
- **Resilience:** A physical-topology guided notion of resilience for power systems is quantified as a six dimensional normalized vector, which is the probabilistic average of such vectors corresponding to the individual credible fault-sequences. A new way of computing *transient stability margin* and *critical clearance time* using sum-of-squares optimization is proposed. Also a novel approach to compute *relay margin* by solving an iterative *quadratic-constraint-quadratic-program* is introduced.

## INDUSTRIAL EXPERIENCE

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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.

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 Global Research Center, 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 exposure to the state-of-the-art of cyber-security analysis and verification framework in the aviation industry, and also to GE's popular Bayesian Hybrid Modelling tool, which uses a Gaussian process based learning technique for modeling and testing of dynamic input-output systems.

## CERTIFICATIONS

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- *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

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### 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

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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

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