# Vahid Rasouli Disfani

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Postdoctoral Scholar in the Center for Energy Research at the University of California San Diego since August 2015 with strong academic background and solid experiences and skills in leading fundamental and applied research projects and advising graduate students.

## Research Interests

### General Topics of Interest

Power system optimization and control, Grid integration of renewable energy resources, Distribution system optimal voltage regulation, Power markets and power system economics.

### Specific Research Topics of Interest

1. Comprehensive feeder-wide optimal voltage control.
2. Efficient grid integration and optimal market participation of distributed energy resources.
3. Distributed, multi-agent optimal power flow algorithms for microgrids with high penetration of renewable energy resources.
4. Reliability assessment of various DERs in microgrid applications.
5. Distributed algorithms for distribution system state estimation.

## Education

- **University of California San Diego** — **San Diego, CA**
  *Postdoctoral Research Associate* — *2015–Present*
- **University of South Florida** — **Tampa, FL**
  *Doctoral of Philosophy, Electrical Engineering* — *2012–2015*
  Dissertation Title: Optimization and Control for Microgrid and Power Electronic Converters
- **Sharif University of Technology** — **Tehran, Iran**
  *Master of Science, Electrical Engineering* — *2006–2008*
- **Amirkabir University of Technology** — **Tehran, Iran**
  *Bachelor of Science, Electrical Engineering* — *2002–2006*

## Employment

### Academic Positions

- **University of California San Diego (UCSD), Center for Energy Research** — **San Diego, CA**
  *Postdoctoral Scholar* — *August 2015–Present*
- **University of South Florida (USF), Smart Grid Power Systems Lab** — **Tampa, FL**
  *Research and Teaching Assistant* — *August 2012–May 2015*

- **Iran Azad University (IAU), Karaj and Damavand Branches** — **Karaj and Damavand, Iran**
  *Undergraduate Course Instructor* — *January 2009–June 2012*

### Industry Positions

- **NEC Laboratories America (NECLA), Energy Management Department** — **Cupertino, CA**
  *Research Assistant (Intern)* — *May 2014–August 2014*

- **Iran Grid Management Company (IGMC), Market Monitoring Department** — **Tehran, Iran**
  *Electricity Market Analyst* — *May 2008–July 2012*

## Research Experience

### As Postdoctoral Scholar at UC San Diego

- **Leading six proposal efforts as co-PI to California Energy Commission and U.S. Department of Energy.** 1 accepted, 2 declined, 2 under review, 1 in preparation.
- **Distributed grid control of flexible loads and DERs for optimized provision of synthetic regulating reserves, funded $2.3M by U.S. Department of Energy (ARPA-E NODES):** *Task 4, Testing and quantification of the impact of DERs for control algorithms and context engine (Sep 2016-Present).*
- **Solar forecast based optimization of distributed energy resources in the Los Angeles Basin and UC San Diego microgrid, funded $1M by California Energy Commission (EPC-14-005):** *Task 3, Develop use cases; submitted the results as a technical report to CEC (Jan-May 2016). Task 4, Optimization of controllable loads and aggregation to virtual power plants (May 2016-Present).*
- **Smart inverter interoperability standards and open testing framework to support high-penetration distributed photovoltaics and storage, funded $2M by California Energy Commission (PON 14-303):** *Task 3, Demonstration and evaluation of impact of high PV penetration using smart inverter with energy storage on the Southern California Edison (SCE) grid; submitted the results as a journal paper to IEEE Transactions on Power Systems (Nov 2015-Jan 2017).*
- **High-fidelity solar forecasting demonstration for grid integration, funded $1.5M by California Public Utilities Commission (California Solar Initiative Round 3):** *Task 4.4, Model predictive on-load tap changer control for high penetrations of PV using sky imager solar forecast; published the results as a technical report and a conference paper (Aug-Dec 2015).*

### As Research Assistant at USF

- **Modeling of large-scale battery systems with SOC prediction capability and development of SOC-based battery management system for both grid-connected and islanding operations of microgrid;** *published the results as a journal paper (Fall 2012).*
- **Community power system modeling and PV/battery remote/optimal operations, sponsored by Duke Energy**; *submitted the final technical report to Duke Energy (Fall 2012-Spring 2013).*
- **Development of novel distributed and multi-agent algorithms for ac and dc optimal power flow problems;** *published the results as one journal and one conference paper (Spring 2013-Fall 2014).*
- **Development of a model predictive control structure and efficient solution for fast-switching model predictive control;** *published the results as a conference paper along with a journal paper (Fall 2013-Spring 2014).*
- **Big data analysis on one-year data acquired from a real PV-battery testbed in St. Pete, Florida for battery degradation study;** *submitted the final technical report to Duke Energy (Spring 2014).*
- **Establishment of a Java-based multi-agent platform using JADE for multi-agent and distributed algorithms cases studies;** *(Fall 2014).*
- **Development of moving-horizon multi-agent optimal power flow considering microgrids with storage and renewable systems integration;** *submitted the results as a journal paper (Fall 2014-Spring 2015).*

### As Research Assistant (Intern) at NECLA

- **Research on distribution system state estimation using MATLAB, python, OpenDSS, and SDPA.** *Developed novel system observability reasoning for semidefinite state estimations; submitted an invention record in August 2014.*

### As Market Analyst at IGMC

- **Performing electricity market data analysis on market participants' behaviors to evaluate market performance;** *co-authored seasonal Iran power market efficiency reports; authored several market procedures on annual market audit and alternative dispute resolution in Iran power market to mitigate possible market power practices.*

## Teaching Experience

- **University of California San Diego** — **La Jolla, CA**
  *Lecturer* — *September 2015-May 2016*
  - Developed and delivered about 30 lectures to graduate students on various topics in power systems such as power system analysis, economics, control, reliability, and power electronics.

- **University of South Florida** — **Tampa, FL**
  *Co-Instructor, Invited Lecturer, Teaching Assistant, Lab Instructor* — *August 2012-May 2015*
  - Co-Instructor: Power System Analysis I (Fall 2014)
  - Guest Lecturer: Power System Analysis II (Fall 2014-Spring 2015)
  - Teaching Assistant: Electromechanical Systems (Fall 2012-Spring 2013), Power Electronics (Fall 2013), Power System Analysis II (Fall 2013)
  - Lab Instructor: Electromechanical Systems (Fall 2012-Spring 2013), Power Electronics (Spring 2014), Power System Analysis II (Spring 2015)

- **Iran Azad university** — **Karaj and Damavand, Iran**
  *Course Developer and Instructor* — *January 2009-June 2012*
  - MATLAB (Spring 2009), Electric Circuits (Fall 2009), Industrial Electronics (Spring 2011), Electric Machines (Fall 2011), Power System Analysis (Spring 2012), Power System Protection and Relays (Spring 2012).

- **Sharif University of Technology** — **Tehran, Iran**
  *Teaching Assistant and Lab Instructor* — *January 2007-June 2008*
  - Teaching Assistant: Engineering Probability and Statistics (Spring-Fall 2007)
  - Lab Instructor: Electric Machines (Spring 2008)

## Student Advising

- **University of California San Diego** — **La Jolla, CA**
  *Co-advisor with Dr. Jan Kleissl* — *August 2015-Present*

1. Ryan Hanna, Ph.D. Candidate
   - The economic value of reliability for microgrid business models.
   - Optimal DER bidding strategy in wholesale electricity markets.
   - **Co-authored one conference paper as the principal advisor.**
2. Abdulelah Habib, Ph.D. Candidate
   - Optimal battery sizing and load scheduling to improve reliability in islanded operation of microgrids.
   - Market-driven battery sizing and operation for microgrids with high renewable penetrations.
   - Quasi-dynamic load and battery sizing and scheduling for stand-alone solar system.
   - **Co-authored one journal (under review) and five conference papers as the principal advisor.**
3. Zachary Pecenak, Ph.D. Student

- Multi-phase distribution feeder reduction.
- Impacts of smart inverters on distribution feeders with high PV penetrations.
- **Co-authored one journal paper (under review) as the principal advisor.**

4. Changfu Li, Ph.D. Student
   - Impacts of optimal tap changer control on PV hosting capacity of distribution feeders.
5. Guang Wang, Ph.D. Student
   - Optimal EV charging control to mitigate adverse voltage impacts of high PV penetrations.

**Tafresh University** — **Tafresh, Iran**
*Co-advisor with Dr. Farzad Razavi* — *August 2008-February 2011*

6. Zahra Kalhori, M.Sc. (Graduated in 2011)
   - Thesis Title: Identifying optimal operating mode for distributed generation considering reliability indices.
7. Mohammad Ali Zahmatkesh, M.Sc. (Graduated in 2010)
   - Thesis Title: Optimal capacitor placement in electrical network of Arak telecommunication center

**Iran Azad University** — **Qazvin, Iran**
*Co-advisor with Dr. Farzad Razavi* — *August 2009-January 2012*

8. Davood Haghshenas, M.Sc. (Graduated in 2012)
   - Thesis Title: Reliability assessment to determine the hotspots of combined cycle power plant and propose consolidated reliability enhancement solutions

## Publications

### Ph.D. Dissertation

1. **Disfani, V.R.**, 2015. *Optimization and Control for Microgrid and Power Electronic Converters.* [Link]

### Peer-Reviewed Journal Papers

2. Habib, A.H., **Disfani, V.R.**, Kleissl, J., and de Callafon, 2017. *Optimal Switchable Load Sizing and Scheduling for Standalone Renewable Energy Systems.* Solar Energy. (To appear). [Link]
3. Yanga, D., Quanb, H., **Disfani, V.R.**, and Liud, L., 2017. *Reconciling Solar Forecasts: Geographical Hierarchy.* Solar Energy. (To appear).
4. **Disfani, V.R.**, Fan, L., Miao, Z. and Ma, Y., 2015. *Fast Model Predictive Control Algorithms for Fast-Switching Modular Multilevel Converters.* Electric Power Systems Research, 129, pp.105-113. [Link]
5. Nafisi, H., Roudsari, H.M., Hosseinian, S.H., Abyaneh, H.A. and **Disfani, V.R.**, 2015. *Active and Reactive Power Transmission Loss Allocation to Bilateral Contracts Through Game Theory Techniques.* Turkish Journal of Electrical Engineering & Computer Sciences, 23(4), pp.1111-1126. [Link]
6. **Disfani, V.R.**, Fan, L., Piyasinghe, L. and Miao, Z., 2014. *Multi-Agent Control of Community and Utility Using Lagrangian Relaxation Based Dual Decomposition.* Electric Power Systems Research, 110, pp.45-54. [Link]
7. Miao, Z., Xu, L., **Disfani, V.R.** and Fan, L., 2014. *An SOC-Based Battery Management System for Microgrids.* IEEE Transactions on Smart Grid, 5(2), pp.966-973. [Link]
8. Khorani, V., Razavi, F. and **Disfani, V.R.**, 2011. *A Mathematical Model for Urban Traffic and Traffic Optimization Using a Developed ICA Technique.* IEEE Transactions on Intelligent Transportation Systems, 12(4), pp.1024-1036. [Link]

### Journal Papers Under Review

9. Pecenak, Z.K., **Disfani, V.R.**, Reno, M.J., and Kleissl, J., 2016. *Multiphase Distribution Feeder Reduction.* Submitted to IEEE Transactions on Power Systems (Request for revision).
10. Li, C., **Disfani, V.R.**, Pecenak, Z., and Kleissl, J., *Optimal On-load Tap Changer Control for Higher PV Hosting Capacity of Distribution Feeders.* Submitted to IEEE Transactions on Smart Grid.

## Peer-Reviewed Conference Papers

11. Pecenak, Z., Kleissl, J. and **Disfani, V.R.**, *Smart Inverter Impacts on California Distribution Feeder with Increasing PV Penetration.* In 2017 IEEE Power & Energy Society General Meeting. IEEE. (To appear) [Link]
12. Habib, A.H., **Disfani, V.R.**, Kleissl, J., and de Callafon, R., *Optimal Energy Storage Sizing and Residential Load Scheduling to Improve Reliability in Islanded Operation of Distribution Grids*. In 2017 American Control Conference (ACC). (To appear)
13. **Disfani, V.R.**, Ubiratan, P. and Kleissl, J., 2016, July. *Model Predictive On-Load Tap Changer Control for High Penetrations of PV Using High Resolution Resources Assessment with Sky Imager.* In 2016 IEEE Power & Energy Society General Meeting. IEEE. [Link]
14. Hanna, R., **Disfani, V.R.**, and Kleissl, J., 2016, September. *A Game-Theoretical Approach to Variable Renewable Generator Bidding in Wholesale Electricity Markets*. In 2016 North American Power Symposium. IEEE. [Link]
15. Habib, A.H., **Disfani, V.R.**, Kleissl, J. and de Callafon, R.A., 2016. *Quasi-Dynamic Load and Battery Sizing and Scheduling for Stand-Alone Solar System Using Mixed-Integer Linear Programming.* 2016 IEEE Conference on Control Applications (CCA). [Link]
16. Habib, A.H., Ratnam, E., **Disfani, V.R.**, Kleissl, J. and de Callafon, R.A., 2016. *Optimization-Based Residential Load Scheduling to Improve Reliability in the Distribution Grid* 2016 Decision Control Conference (CDC). [Link]
17. **Disfani, V.R.**, Fan, L. and Miao, Z., 2015, July. *Distributed DC Optimal Power Flow for Radial Networks Through Partial Primal Dual Algorithm.* In 2015 IEEE Power & Energy Society General Meeting. IEEE. [Link]
18. Habib, A.H., Pecenak, Z.K., **Disfani, V.R.**, Kleissl, J. and de Callafon, R.A., 2015. *Reliability of Dynamic Load Scheduling with Solar Forecast Scenarios*. In 2016 Annual IEEE Systems Conference (SysCon). [Link]
19. Khazaei, J., Piyasinghe, L., **Disfani, V.R.**, Miao, Z., Fan, L. and Gurlaskie, G., 2015, July. *Real-Time Simulation and Hardware-In-the-Loop Tests of a Battery System.* In 2015 IEEE Power & Energy Society General Meeting. IEEE. [Link]
20. Ma, Y., Miao, Z., **Disfani, V.R.** and Fan, L., 2014, July. *A One-Step Model Predictive Control for Modular Multilevel Converters*. In 2014 IEEE PES General Meeting| Conference & Exposition. IEEE. [Link]
21. Moghadam, M.F., **Disfani, V.R.**, Abyaneh, H.A. and Razavi, F., 2010, June. *A Novel Method for Hysteresis Based Control of UPFC*. In Power Engineering and Optimization Conference (PEOCO), 2010 4th International (pp. 112-116). IEEE. [Link]
22. **Disfani, V.R.**, Razavi, F., Kashanizadeh, B. and Dargahi, S., 2009, June. *Transmission Loss Allocation of Bilateral Contracts Using Load Flow Permutations Average Method.* In PowerTech, 2009 IEEE Bucharest. IEEE. [Link]

## Technical Reports

23. **Disfani, V.R.**, Bozchalui, M.C. and Sharma, R., 2014. *SDP-based State Estimation of Multi-Phase Active Distribution Networks Using Micro-PMUs*. NEC Laboratories America. [Link]
24. **Disfani, V.R.**, Ubiratan, P. and Kleissl, J., 2015. *Model Predictive On-Load Tap Changer Control for High Penetrations of PV Using Sky Imager Solar Forecast.* California Public Utilities Commission California Solar Initiative. [Link]
25. Nguyen, D.A., Ubiratan, P., Velay, M., Hanna, R., Kleissl, J., Schoene, J., Zheglov, V., Kurtz, B., Torre, B. and **Disfani, V.R.**,2015. *Impact Research of High Photovoltaics Penetration Using High Resolution Resource Assessment with Sky Imager and Power System Simulation.* California Public Utilities Commission California Solar Initiative. [Link]

## Working Papers

26. **Disfani, V.R.**, Pecenak, Z., Li, C. and Kleissl, J., *Feeder-Wide Optimal Voltage Control using Mixed-Integer Convex Programming*.
27. Habib, A.H., **Disfani, V.R.**, Kleissl, J., and de Callafon, R., *Market-Driven Energy Storage Optimization for Microgrids with Renewable Energy Systems Using Stochastic Programming*.
28. Habib, A.H., **Disfani, V.R.**, Kleissl, J., and de Callafon, R., *Dynamic-Constrained Load Sizing and Scheduling for Stand-Alone Solar System Using Mixed-integer Linear Programming*.
29. Boacha, S., **Disfani, V.R.**, Pecenak, Z., and Kleissl, J., *Coordinated Smart Inverters: Control Design, Effectiveness, and Stability*.

## Invited Talks and Conference Presentations

1. ***Optimal On-Load Tap Changer Control for Higher PV Hosting Capacity of Distribution Feeders***, Seminars in Energy, Center for Energy Research, University of California, San Deigo, CA – January 18, 2017.
2. ***Model Predictive On-Load Tap Changer Control for High Penetrations of PV Using High Resolution Resources Assessment with Sky Imager***, IEEE Power & Energy Society General Meeting 2016, Boston, MA – July 21, 2016.
3. ***A Game-Theoretical Approach to Variable Renewable Generator Bidding in Wholesale Electricity Markets***, Stanford University, Palo Alto, CA – June 7, 2016.
4. ***Model Predictive On-Load Tap Changer Control for High Penetrations of PV Using Sky Imager Solar Forecast***, Center for Energy Research, University of California, San Diego, CA – March 8, 2016.
5. ***Impacts of Accurate Solar Resource Input from Sky Imager on Distribution Network Power System Simulation***, San Diego Gas & Electric, San Diego, CA – November 17, 2015.
6. ***SDP-based State Estimation of Multi-Phase Active Distribution Networks Using Micro-PMUs***, NEC Laboratories America, Cupertino, CA – August 12, 2014.

## Memberships, Awards, and Honors

1. M.Sc. Fellowship, Sharif University of Technology, 2006-2008.
2. B.Sc. Fellowship, Amirkabir University of Technology, 2002-2006.
3. Ranked 13, Iran nationwide M.S. admission test, among more than 15000 applicants, 2006.
4. Ranked 405, Iran nationwide B.S. admission test, among more than 500,000 applicants, 2002.
5. IEEE Membership, 2013-Present.

## Professional Services

### Journal Review Services

1. IEEE Transactions on Sustainable Energy, 16 reviews since April 2014.
2. IEEE Transactions on Smart Grid, 5 reviews since August 2015.
3. IEEE Transactions on Power Systems, 2 reviews since October 2015.
4. Journal of Electric Power System Research (Elsevier), 3 reviews since November 2015.
5. Journal of Solar Energy (Elsevier), one review in March 2016.
6. Journal of Test and Evaluation (ASTM), one review in July 2015.

### Conference Review Services

7. IEEE Power and Energy Society General Meetings (PESGM), 2014-2017.
8. 2016 IEEE International Conference on Industrial Technology (ICIT).
9. 11th and 12th International Conferences on Environment and Electrical Engineering (EEEIC), 2012-2013.

## Technical and Personal skills

- **Numerical analysis:** game theory, optimization, stochastic processes, big data analysis, statistics and probability, statistical model design, reliability evaluation, estimation and prediction theory.
- **Programming languages:** Proficient in MATLAB, Simulink, C/C++, Python, LATEX
  Also basic ability with: Assembly, VBA, SQL, MS Access.
- **Simulation and optimization skills:** Simulink, MATPOWER, OpenDSS, PSCAD, PowerFactory DIgSILENT, GAMS, CPLEX, CVX, SDPA.
- **Hardware Hands-on Experience:** Hardware-In-the-Loop (HIL) setup, RT-LAB, dSPACE, PV emulators, energy storage systems.
- **General Skills:** Excellent mathematical analysis, independent research skills, good presentation skills, works well in a team.
- **Communication Skills:** Public speaking, teaching, academic paper writing and presentation.