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# Scott J. Moura

Ph.D. Candidate  
Department of Mechanical Engineering  
University of Michigan, Ann Arbor  
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## Education

### **President's Postdoctoral Fellow (2011-2012)**

**University of California, San Diego**

Topic: *PDE Control and Estimation Techniques for Advanced Battery Management Systems*  
Advisors: Professor Miroslav Krstić  
Major Field: Systems and Controls

### **Ph.D., Mechanical Engineering (2011)**

**University of Michigan, Ann Arbor**

Dissertation: *Techniques for Battery Health Conscious Power Management via Electrochemical Modeling and Optimal Control*  
Advisors: Professor Jeffrey L. Stein (Michigan) and Professor Hosam K. Fathy (Penn State)  
Committee: Prof. Jeffrey Stein (Michigan-ME), Prof. Hosam Fathy (Penn State-MNE), Prof. Hwei Peng (Michigan-ME), Prof. Jessy Grizzle (Michigan-EECS:Systems)  
Major Field: Systems and Controls

### **M.S.E, Mechanical Engineering (2008)**

**University of Michigan, Ann Arbor**

Thesis: *Plug-in Hybrid Electric Vehicle Power Management: Optimal Control & Battery Sizing*  
Advisors: Professor Jeffrey L. Stein (Michigan), Professor Hosam K. Fathy (Penn State), and Professor Duncan S. Callaway (UC Berkeley)  
Major Field: Systems and Controls

### **B.S., Mechanical Engineering (2006)**

**University of California, Berkeley**

Graduated with Honors

## Research Interests

Optimal control, stochastic control, distributed parameter systems, dynamic system modeling, sustainable & alternative energy storage/conversion systems, advanced battery systems, vehicle electrification and vehicle-to-grid applications.

## Publications & Presentations

### **Peer-Reviewed Journals (Accepted)**

1. [S. J. Moura](#), H. K. Fathy, D. S. Callaway, and J. L. Stein, "A Stochastic Optimal Control Approach for Power Management in Plug-in Hybrid Electric Vehicles," *IEEE Transactions on Control Systems Technology*, v PP, n 99, p 1-11, March 2010.
2. [S. J. Moura](#), D. S. Callaway, H. K. Fathy, and J. L. Stein, "Impact of Battery Sizing on Stochastic Optimal Power Management in Plug-in Hybrid Electric Vehicles," *Journal of Power Sources*, v 195, n 9, p 2979-2988, May 2010.
3. S. Bashash, [S. J. Moura](#), J. C. Forman, and H. K. Fathy, "Plug-in hybrid electric vehicle charge pattern optimization for energy cost and battery longevity," *Journal of Power Sources*, v 196, n 1, p 541-549, January 2011.

4. S. J. Moura, J. C. Forman, S. Bashash, J. L. Stein, and H. K. Fathy, "Optimal Control of Film Growth in Lithium-Ion Battery Packs via Relay Switches," *accepted to IEEE Transactions on Industrial Electronics* in September 2010.

#### **Peer-Reviewed Journals (In Review or In Preparation)**

5. S. Bashash, S. J. Moura, and H. K. Fathy, "On the Aggregated Grid Load Imposed by Battery Health-Conscious Charging of Plug-in Hybrid Electric Vehicles," (in review).
6. S. J. Moura, J. L. Stein, and H. K. Fathy, "Battery Health Conscious Power Management in Plug-in Hybrid Electric Vehicles via Electrochemical Modeling and Stochastic Control," (in review).
7. J. C. Forman, S. J. Moura, J. L. Stein, H. K. Fathy, "Genetic Parameter Identification of the Doyle-Fuller-Newman Model from Experimental Cycling of a LiFePO<sub>4</sub> Battery and Fisher Information" (in preparation).
8. S. J. Moura and Y. A. Chang, "Lyapunov-Based Switched Extremum Seeking for Maximum Power Point Tracking in Photovoltaic Systems," (in preparation).
9. S. J. Moura, J. B. Siegel, H. K. Fathy, A. G. Stefanopoulou, "Education on Vehicle Electrification: Battery Systems and Control," (in preparation).
10. S. J. Moura, J. L. Stein, and H. K. Fathy, "Optimal Boundary Control and Estimation of Diffusion-Reaction PDEs," (in preparation).

#### **Conferences Proceedings**

1. S. J. Moura, H. K. Fathy, D. S. Callaway, J. L. Stein, "A Stochastic Optimal Control Approach for Power Management in Plug-in Hybrid Electric Vehicles," *Proceedings of the 2008 ASME Dynamic Systems and Control Conference*, Ann Arbor, MI, 2008.
2. S. J. Moura, D. S. Callaway, H. K. Fathy, and J. L. Stein, "Impact of Battery Sizing on Stochastic Optimal Power Management in Plug-in Hybrid Electric Vehicles," *Proceedings of the 2008 IEEE International Conference on Vehicular Electronics and Safety*, pp. 96-102, Columbus, OH, 2008. (Invited Paper)
3. Y. A. Chang, S. J. Moura, "Real-Time Air-Flow Control in Fuel Cell Systems: An Extremum Seeking Approach," *Proc. of the 2009 American Control Conference*, St. Louis, MO, 2009.
4. S. J. Moura, J. C. Forman, J. L. Stein, H. K. Fathy, "Control of Film Growth in Lithium Ion Battery Packs via Switches," *Proceedings of the 2009 ASME Dynamic Systems and Control Conference*, Hollywood, CA, 2009. **Best Student Paper Finalist**
5. S. J. Moura, Y. A. Chang "Asymptotic Convergence through Lyapunov-Based Switching in Extremum Seeking with Application to Photovoltaic Systems," *Proceedings of the 2010 American Control Conference*, Baltimore, MD, 2010.
6. S. Bashash, S. J. Moura, H. K. Fathy "Charge Trajectory Optimization of Plug-in Hybrid Electric Vehicles for Energy Cost Reduction and Battery Life Enhancement," *Proceedings of the 2010 American Control Conference*, Baltimore, MD, 2010.
7. S. J. Moura, J. B. Siegel, D. J. Siegel, H. K. Fathy, A. G. Stefanopoulou, "Education on Vehicle Electrification: Battery Systems, Fuel Cells, and Hydrogen," *Proceedings of the 2010 IEEE Vehicle Power and Propulsion Conference*, Lille, France, 2010.
8. S. J. Moura, J. L. Stein, H. K. Fathy, "Battery Health-Conscious Power Management for Plug-in Hybrid Electric Vehicles via Stochastic Control," *Proceedings of the 2010 ASME Dynamic Systems and Control Conference*, Cambridge, MA, 2010.

9. S. Bashash, S. J. Moura, H. K. Fathy, “Battery Health-Conscious Plug-in Hybrid Electric Vehicle Power Demand Prediction,” *Proceedings of the 2010 ASME Dynamic Systems and Control Conference*, Cambridge, MA, 2010.
10. S. J. Moura, H. K. Fathy, “Optimal Boundary Control & Estimation of Diffusion-Reaction PDEs,” *Proceedings of the 2011 American Control Conf.*, San Francisco, CA, 2011. **Best Student Paper Finalist**
11. J. C. Forman, S. J. Moura, J. L. Stein, H. K. Fathy, “Genetic Parameter Identification of the Doyle-Fuller-Newman Model From Experimental Cycling of a Li-ion LiFePO<sub>4</sub> Battery,” Submitted to the *2011 American Control Conference*, San Francisco, CA, 2011.

### Invited Talks

- Tesla Motors (Mar 2011)  
“Battery Health Conscious Power Management in Plug-in Hybrid Electric Vehicles via Electrochemical Modeling & Stochastic Control”
- University of Illinois, Urbana-Champaign (Feb 2011)  
“Optimal Control of Lithium-ion Battery Energy Storage Systems”
- California Institute of Technology (Jan 2011)  
“Optimal Control of Lithium-ion Battery Energy Storage Systems”
- Ford Motor Company (Dec 2010)  
“Optimal Control of Lithium-ion Battery Energy Storage Systems”
- Colorado State University (Dec 2010)  
“Optimal Control of Lithium-ion Battery Energy Storage Systems”
- Syracuse University (Nov 2010)  
“Optimal Control of Lithium-ion Battery Energy Storage Systems”

### Technical Presentations

- S. J. Moura, H. K. Fathy, D. S. Callaway, and J. L. Stein, “Interaction of Battery Size and Optimal Power Management in Plug-in Hybrid Electric Vehicles,” *Automotive Research Center Conference*, Ann Arbor, MI, 2009.
- S. J. Moura, D. S. Callaway, H. K. Fathy, and J. L. Stein, “Plug-in Hybrid Electric Vehicle Power Management: Optimal Control and Battery Sizing,” *Society of Hispanic Professional Engineers Conference*, Phoenix, AZ, 2008. **Technical Paper Competition Winner**
- S. J. Moura, D. S. Callaway, H. K. Fathy, and J. L. Stein, “Plug-in Hybrid Electric Vehicle Power Management: Optimal Control and Battery Sizing,” *Engineering Graduate Symposium*, Ann Arbor, MI, 2008. **2<sup>nd</sup> Place Poster, System Analysis and Control Session**
- S. J. Moura, H. K. Fathy, D. S. Callaway, and J. L. Stein, “A Stochastic Optimal Control Approach for Power Management in Plug-in Hybrid Electric Vehicles,” *Automotive Research Center Conference*, Ann Arbor, MI, 2008.
- S. J. Moura, H. K. Fathy, D. S. Callaway, and J. L. Stein, “Plug-in Hybrid Powertrain Modeling,” *Engineering Graduate Symposium*, Ann Arbor, MI, 2007. **2<sup>nd</sup> Place Oral Presentation, System Analysis and Control Session**

- S. J. Moura, Dongsuk Kum, H. K. Fathy, and J. L. Stein, “Hybrid Powertrain Optimization for Plug-in Microgrid Power Generation,” *Automotive Research Center Conference*, Ann Arbor, MI, 2007.

## **Awards & Honors**

### **University of California Presidential Postdoctoral Fellowship**

University of California (2011 - 2012)

### **National Science Foundation (NSF) Graduate Research Fellowship**

National Science Foundation (2008 - 2011)

### **Rackham Merit Fellowship (RMF)**

University of Michigan Rackham Graduate School (2006 – 2011)

### **Distinguished Leadership Award**

College of Engineering, University of Michigan (2009)

### **2011 American Control Conference, San Francisco, CA USA**

Best Student Paper Finalist

### **2009 ASME Dynamic Systems and Control Conference, Hollywood, CA USA**

Best Student Paper Finalist

Best Presentation in Session

### **2009 American Control Conference, Baltimore, MD USA**

Best Presentation in Session

### **2008 ASME Dynamic Systems and Control Conference, Ann Arbor, MI USA**

Best Presentation in Session

### **2008 Society of Hispanic Professional Engineers Conference, Phoenix, AZ USA**

1<sup>st</sup> Place Technical Paper Competition

### **2008 Engineering Graduate Symposium, University of Michigan**

2<sup>nd</sup> Place Poster, Control Systems Session

### **2007 Engineering Graduate Symposium, University of Michigan**

2<sup>nd</sup> Place Oral Presentation, System Analysis and Control Session

### **Michigan Memorial Phoenix Energy Institute (MMPEI)**

MMPEI-Rackham Energy Fellowship, Honorable Mention (2007 – 2008)

### **SHPE Academic Achievement Award**

Society of Hispanic Engineers and Scientists, University of Michigan (2007)

### **National Science Foundation (NSF)**

Graduate Research Fellowship Program (GRFP), Honorable Mention (2006 – 2007)

### **Christopher A. Burrows Memorial Scholarship**

Community Scholarship Foundation (2002)

### **Paul Rickershauser Memorial Award**

Community Scholarship Foundation (2002)

### **The Governor’s Scholars Award**

Governor’s Scholarship Programs (2001)

## Teaching Experience

- ME 499/599: Battery Systems & Control (Winter 2011)  
Co-Instructor and co-developer for new course within DOE-ARRA education program  
Enrollment: 50
- ME 499/599: Battery Systems & Control (Winter 2010)  
Co-Instructor and co-developer for new course within DOE-ARRA education program  
Enrollment: 59
- Undergraduate Research Assistant Mentor (Summer 2010)  
“Li-ion Battery Float Charger Design and Fabrication”
- 10<sup>th</sup> Grade Preparatory Math (Summer 2005)  
Campbell Academic Services, ACES, Detroit, MI
- Drum Major (Summer 2004)  
Mystikal Drum & Bugle Corps, Newbury Park, CA

## Society Memberships

### **American Society of Mechanical Engineers (ASME)**

Student Member, Dynamic Systems and Control Division (2002 – present)

### **Institute of Electrical and Electronics Engineers (IEEE)**

Student Member, Control Systems Society (2008 – present)

Student Member, Industrial Electronics Society (2010 – present)

### **Society of Hispanic Professional Engineers (SHPE)**

University of Michigan, Student Chapter (2006 – present)

Community Service Committee (Sept. 2007 – present)

UC Berkeley Hispanic Engineers & Scientists, Student Chapter (2002 - 2006)

Administrative Vice-President (2004-2006)

## Academic Service

### *Reviewer*

- **Journals:** ASME Journal of Dynamics Systems, Measurement, and Control; Energies; IEEE Trans. on Control Systems Technology; IEEE Trans. on Industrial Electronics; IEEE/ASME Trans. on Mechatronics; Simulation Modeling Practice and Theory.
- **Conferences:** ASME Dynamics Systems and Control Conference; ASME International Mechanical Engineering Congress & Exposition; American Control Conference; European Control Conference; IEEE Forum on Integrated and Sustainable Transportation System; IEEE Conference on Decision and Control; IEEE Vehicle Power and Propulsion Conference

### *Session Chair*

- 2009 University of Michigan Graduate Symposium, Design & Control Systems Session
- 2008 University of Michigan Graduate Symposium, Control Systems Session

### *Web Design*

- Student Services Site for the 2009 American Control Conference, St. Louis, MO
- 2008 and 2009 University of Michigan Graduate Symposium
- International Union of Theoretical and Applied Mechanics (IUTAM) Symposium on Cellular, Molecular and Tissue Mechanics, Woods Hole, MA

## **Appointments and Experience**

**University of California, San Diego** (July 2011 – June 2012)  
*President's Postdoctoral Fellow*

**University of Michigan** – Ann Arbor, Michigan (August 2006 – April 2011)  
*Graduate Student Research Assistant*

**DaimlerChrysler Corporation** – Detroit, Michigan (May 2006 - August 2006)  
*Summer Intern, Electrical Engineering - Vehicle Engineering*

**Ford Motor Company** - Dearborn, Michigan (May 2005 - August 2005)  
*Summer Intern, Manufacturing & Quality*

**Southern California Edison** - Rosemead, California (June 2004 - August 2004)  
*Professional Aide, Staff Engineering*

**BIS Computer Solutions, Inc.** - La Crescenta, California (June 2003 - July 2003)  
*Sales Assistant, Computer Technician*

## **Instrumental Music Experience**

### **Instruments**

Oboe, English horn, Alto/Tenor/Baritone Sax, Timpani, Cymbals, Bass Drum, Conducting

### **Performance Groups**

University of Michigan Pops Orchestra (September 2010 – April 2011)

University of Michigan Campus Philharmonic Orchestra (September 2009 – March 2010)

University of Michigan Campus Band (January 2009 – April 2009)

UC Berkeley Symphony Orchestra (2003 - 2006)

UC Berkeley University Wind Ensemble (January 2003 – May 2006)

California Marching Band (September 2003 – May 2006)

Mystikal Drum & Bugle Corps (April 2004 – July 2004)