

# Behzad Samadi

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## CONTACT INFORMATION

email: behzad@mechatronics3d.com  
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## RESEARCH INTERESTS

model predictive control, automatic code generation, automotive control systems, convex optimization, model-based fault detection and isolation, uncertainty analysis, sensitivity analysis, model order reduction, piecewise affine systems, controller synthesis for nonsmooth systems

## PROFESSIONAL EXPERIENCE

**Maplesoft**, Waterloo, Ontario, Canada

*Research Engineer*

**January 2012 – Present**

- Developing symbolic computation tools for engineering applications
  - Automatic code generation for model predictive controllers
  - Model predictive control for autonomous race cars
  - Code optimization
  - Uncertainty analysis
  - Robust linear control
  - System identification
  - Piecewise affine approximation
  - Building a Modelica library for automotive engines

**Concordia University**, Montreal, Quebec, Canada

*Research Associate*

**September 2011 – December 2011**

- PWATOOLS, a numerical toolbox for the analysis and synthesis of piecewise affine systems

**Amirkabir University of Technology**, Tehran, Iran

*Assistant Professor*

**September 2008 – August 2011**

- Graduate projects (Electrical Engineering)
  - Stability analysis and controller synthesis for discrete-time piecewise affine systems
  - Modeling, detection and estimation of control valve stiction
- Graduate projects (Mechatronics)
  - Active Front Steering (AFS)
  - Electronic Stability Program (ESP)
- Undergraduate projects
  - Virtual Robotics Lab
  - LEGO Mindstorms NXT: Segway, Ballbot, Bike, Ball on plate
  - 2D inverted pendulum on a mobile robot with holonomic wheels
  - Pendubot
  - Chemical process simulation and control using HYSYS

**Concordia University**, Montreal, Quebec, Canada

*Postdoctoral Fellow*

**June 2008 – September 2008**

- Developed new synthesis methods for piecewise smooth systems

**Concordia University**, Montreal, Quebec, Canada

*Research Assistant*

**September 2003 – April 2008**

- Developed new analysis and synthesis methods for piecewise affine and piecewise polynomial systems

**Jovain Electrical Machines Co.**, Tehran, Iran

*Research Engineer*

**April 2002 – August 2003**

- Electric Vehicle Component Sizing
- Control algorithm design for the Traction Control System (TCS) of an electric vehicle with independent driven wheels

**Noavar Tadbir Co.**, Tehran, Iran

*Hardware Design Engineer*

**September 2001 – February 2002**

- Designed electronic controllers for home appliances

**University of Tehran**, Tehran, Iran

*Software Designer*

**January 2001 – November 2001**

- Developed a user-friendly vehicle dynamics simulation software

**R&D Center, Irankhodro Industrial Group**, Tehran, Iran

*Research Engineer*

**June 2000 – July 2001**

- Developed a vehicle dynamics simulation software considering mathematical models for vehicle dynamics, brake system, engine, gearbox, transmission, steering system and sensors
- Developed a 3D animation for vehicle dynamics simulation
- Developed control and estimation algorithms for Antilock Braking System (ABS) and Traction Control System (TCS) considering lateral stability
- Developed tire force estimation algorithms based on Kalman filter
- Assisted the installation of the ABS MK20E on a new passenger car
- Assisted the design of an OBD-II diagnoser

**Pars Telephone Kar Co.**, Tehran, Iran

*Hardware Design Engineer*

**September 1996 – April 1998**

- Designed a security card for a PABX (Private Automatic Branch eXchange)
- Developed assembly programs for MCS51 microcontrollers

## EDUCATION

**Concordia University**, Montreal, Quebec, Canada

Ph.D. Mechanical Engineering, April 2008

- Dissertation topic: *Stability Analysis and Controller Synthesis for a Class of Piecewise Smooth Systems*

**Amirkabir University of Technology**, Tehran, Iran

M.Sc. Electrical Engineering, February 1999

- Thesis topic: *Model-based fault detection, identification and accommodation in Antilock Braking System (ABS)*

**Sharif University of Technology**, Tehran, Iran

B.Sc. Electrical Engineering, August 1996

- Thesis topic: *Stability analysis of SF<sub>6</sub> gas circuit breakers*

## TEACHING EXPERIENCE

**Amirkabir University of Technology**, Tehran, Iran

- Convex Optimization and Applications, Graduate course **Winter 2011**
- Industrial Mechatronics, Graduate course **Winter 2011**
- Industrial Control **Winter 2011**
- Digital Control Systems **Fall 2010**
- Convex Optimization and Applications, Graduate course **Winter 2010**

- Advanced Industrial Control, Graduate course Winter 2010
- Industrial Control Winter 2010
- Linear Control Systems Fall 2009
- Industrial Control Winter 2009

**Concordia University**, Montreal, Quebec, Canada

- Switched and Hybrid Control Systems, Teaching Assistant Summer 2007
- Control System Design, Lab Tutor Fall 2006
- Fundamentals of Control Systems, Teaching Assistant Winter 2004

**Amirkabir University of Technology**, Tehran, Iran

- Electrical Circuits, Teaching Assistant Winter 1998

**Sharif University of Technology**, Tehran, Iran

- Linear Control Systems, Teaching Assistant Fall 1996

- HONOURS AND AWARDS
- Doctoral research scholarship for international students, Le Fonds québécois de la recherche sur la nature et les technologies (FQRNT)
  - Concordia University Campaign for a New Millennium Graduate Scholarship - Engineering & Computer Science
  - Concordia University Graduate Fellowship
  - Concordia University International Tuition Fee Remission Award
  - An honorary award for achieving the first rank among control engineering applicants in the nationwide university entrance examination in Iran

PUBLICATIONS **Articles published in refereed journals:**

1. K. Walker, **B. Samadi**, M. Huang, J. Gerhard, K. Butts, and I. Kolmanovsky, "Design Environment for Nonlinear Model Predictive Control," SAE Technical Paper# 2016-01-0627.
2. J. V. Deshmukh, H. Ito, X. Jin, J. Kapinski, K. Butts, J. Gerhard, **B. Samadi**, K. Walker, and Y. Xie, "Piecewise-Affine Approximations for a Powertrain Control Verification Benchmark," *ARCH CPSWeek*, pp 98 - 112, 2015.
3. **B. Samadi**, and L. Rodrigues, "A sum of squares approach to backstepping controller synthesis for piecewise affine and polynomial systems," *International Journal of Robust and Nonlinear Control*, vol. 24, no. 16, pp. 2365 - 2387, 2014.
4. **B. Samadi** and L. Rodrigues, "A sum of squares approach to backstepping controller synthesis for piecewise affine and polynomial systems," *Int. J. Robust Nonlinear Control*, 2013.
5. **B. Samadi** and L. Rodrigues, "A Unified Dissipativity Approach for Stability of Piecewise Smooth Systems," *Automatica*, vol. 47, no. 12, pp. 2735 - 2742, Dec. 2011.
6. **B. Samadi** and L. Rodrigues, "Stability of Sampled-Data Piecewise Affine Systems: A Time-Delay Approach," *Automatica*, vol. 45, no. 9, pp. 1995 - 2001, Sep. 2009.
7. **B. Samadi** and L. Rodrigues, "A duality-based convex optimization approach to  $L_2$ -gain control of piecewise affine slab differential inclusions," *Automatica*, vol. 45, no. 3, pp. 812 - 816, Mar. 2009.
8. **B. Samadi** and L. Rodrigues, "Extension of local linear controllers to global piecewise affine controllers for uncertain non-linear systems," *International Journal of Systems Science*, vol. 39, no. 9, pp. 867 - 879, Sep. 2008.
9. F. Tahami, R. Kazemi, Sh. Farhangi and **B. Samadi**, "Fuzzy based stability enhancement system for a four-motor-wheel electric vehicle," *SAE 2002 Transactions - Journal of Passenger cars: Mechanical Systems*, paper no. 2002-01-1588, pp. 1825 - 1833.
10. **B. Samadi** and K. Y. Nikravesh, "Improvement of vehicle handling by differential braking," *Sharif's Scientific Research Quarterly*, Sharif University of Technology, Mar. 2002 (in Persian).
11. **B. Samadi** and K. Y. Nikravesh, "Estimation of vehicle speed and tire-road friction forces," *Amirkabir Journal of Science and Technology*, Amirkabir University of Technology, vol.12, no. 46, pp. 237-245, Spring 2001. (in Persian).

## Papers in refereed conference proceedings:

1. S. Kaynama, **B. Samadi**, and L. Rodrigues, "A Convex Formulation of Controller Synthesis for Piecewise-Affine Slab Systems Based on Invariant Sets", In *the 51st IEEE Conference on Decision and Control*, Maui, Hawaii, USA, December 2012
2. M. Zamani Fekri, **B. Samadi**, L. Rodrigues, "PWATOOLS: A MATLAB Toolbox For Piecewise-Affine Controller Synthesis, In *Proc. of the American Control Conference*, pp. 4484-4489, Montreal, QC, Canada, June 2012
3. N. Elmi and **B. Samadi**, "Handling safety improvement for steer-by-wire vehicle using fuzzy controller," In *the 2nd International Conference on Control, Instrumentation and Automation (ICCIA)*, pp.144-149, 27-29 Dec. 2011
4. A. Farshad and **B. Samadi**, "Controller design for vehicle stability improvement using optimal distribution of tire forces," In *the 2nd International Conference on Control, Instrumentation and Automation (ICCIA)*, pp.174-179, 27-29 Dec. 2011
5. Y. Arbabi Yazdi and **B. Samadi**, "Modelling and quantification of valve stiction by unknown input estimation," In *the 19th Iranian Conference on Electrical Engineering (ICEE)*, pp.1, 17-19 May 2011
6. **B. Samadi** and L. Rodrigues, "Backstepping Controller Synthesis for Piecewise Polynomial Systems: A Sum of Squares Approach," In *Proc. of the American Control Conference*, St. Louis, MO, Jun. 2009.
7. **B. Samadi** and L. Rodrigues, "Sampled-Data Piecewise Affine Slab Systems: A Time-Delay Approach," In *Proc. of the American Control Conference*, Seattle, WA, Jun. 2008.
8. **B. Samadi** and L. Rodrigues, "Controller synthesis for piecewise affine slab differential inclusions: a duality-based convex optimization approach," In *Proc. of the 46th Conference on Decision and Control*, New Orleans, LA, Dec. 2007.
9. **B. Samadi** and L. Rodrigues, "Backstepping Controller Synthesis for Piecewise Affine Systems: A Sum of Squares Approach," In *Proc. of the IEEE International Conference on Systems, Man, and Cybernetics (SMC 2007)*, Montreal, QC, Oct. 2007.
10. **B. Samadi** and L. Rodrigues, "Extension of a local linear controller to a stabilizing semi-global piecewise-affine controller," In *7th Portuguese Conference on Automatic Control*, Lisbon, Portugal, Sep. 2006.
11. F. Tahami, R. Kazemi, Sh. Farhangi and **B. Samadi**, "Fuzzy based stability enhancement system for a four-motor-wheel electric vehicle," In *SAE Automotive Dynamics and Stability Conference*, Detroit, MI, May 2002.
12. **B. Samadi**, R. Kazemi, K. Y. Nikravesh and M. Kabganian, "Real-time estimation of vehicle state and tire-road friction forces," In *Proc. of the American Control Conference*, Arlington, VA, June 2001.
13. **B. Samadi** and K. Y. Nikravesh, "Improvement of vehicle handling by differential braking," In *Proc. of the 4th International and 8th Annual Conference of Iranian Society of Mechanical Engineering*, Sharif University of Technology, May 2000 (in Persian).
14. **B. Samadi** and K. Y. Nikravesh, "Sliding mode controller for wheel slip control," In *Proc. of the 7th Iranian Conference on Electrical Engineering*, Iran Telecommunication Research Center, May 1999 (in Persian).

## SKILLS

- Professional software: Maple, MapleSim, MATLAB, Simulink, SeDuMi, PENBMI, Yalmip, SOS-TOOLS, MPT Toolbox, xPC Target, RTX, WinCon, C/C++, Spice, Orcad, VRML, Carsim, ADAMS and Working Model
- Simulation: USARSim, Gazebo, MORSE, ODE.
- Hardware: Arduino, Microchip PIC, x86, ARM and LEGO Mindstorms.
- Publishing: L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>, Libre Office, Microsoft Office, Google Docs, Inkscape and GIMP.
- Web: jQuery, MochaUI, Vaadin, GWT, Ext JS, XAMPP, Eclipse, Aptana, NetBeans, Joomla, Wordpress, Blogger, Xoops, Wikimedia, FreeMind and KompoZer