

# KIAN JALAEDDINI, PHD

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## EDUCATION.....

- **Ph.D., Biomedical Engineering, McGill University**, Montréal, QC, Canada, 2009-2015.
  - **Dissertation:** Subspace Identification of Biomedical Systems: Application to Dynamic Joint Stiffness.
  - **Adviser:** Prof. Robert E. Kearney.
- **M.Sc., Electrical Engineering, Concordia University**, Montréal, QC, Canada, 2007-2009.
  - **Dissertation:** Rate Assignment in Wireless Networks: Stability Analysis and Controller Design.
  - **Adviser:** Prof. Amir G. Aghdam.
- **B.Sc., Control/Electrical Engineering, University of Tehran**, Tehran, Iran, 2002-2007.

## RESEARCH EXPERIENCE.....

- **Postdoctoral Fellow, Division of Biokinesiology and Physical Therapy, University of Southern California**, Los Angeles, CA, USA, 2015-present.
  - Designed and implemented the first synthetic spinal cord that actuates robotic and anatomical (cadaveric) joints and provides mechanistic interrogation of the neuromuscular system.
  - Performed a comprehensive test of the synthetic spinal cord using data analysis techniques that shed light on healthy and pathologic finger function.
  - Increased productivity by mentoring multiple teams of graduate and undergraduate students in delivering project goals using Scrum management techniques.
- **Research Assistant, McGill University**, Montréal, QC, Canada, 2009-2015.
  - Designed, implemented and validated novel system identification tools to analyze biomedical signals and systems that outperformed existing tools in real-world, experimental conditions.
  - Designed and performed experiments on healthy human subjects and identified mathematical models of their ankle joint biomechanics with significance in the design of a *powered* ankle-foot orthosis.

- Discovered novel properties of the spinal reflex responses in healthy and pathologic subjects with significance in noninvasive, objective assessment of neuromuscular conditions.
- **Research Assistant, Concordia University**, Montréal, QC, Canada, 2007-2009.
  - Designed and introduced a novel control algorithm for CDMA wireless communication channels that efficiently minimized network interference and ensured stability.

## TEACHING EXPERIENCE .....

- Guest Lecturer, *Neuromuscular Systems*, Fall 2015-2016, University of Southern California.
- Teaching Assistant, *BME Modelling and Identification*, Winter 2013, McGill University.
- Teaching Assistant, *Biomedical Signals and Systems*, Fall 2010, McGill University.
- Teaching Assistant, *Principals of Electrical Engineering*, three semesters, 2008-2009, Concordia University.
- Teaching Assistant, *Digital System Design*, Winter 2008, Concordia University.

## HONORS AND AWARDS.....

- Postdoctoral Research Scholarship, Fonds de Recherche du Québec Nature et Technologies (FRQNT), 2015-2017.
- Excellence Award, Biomedical Engineering Department, McGill University, 2015.
- IEEE Montréal Section Outstanding Volunteer, 2013.
- Finalist, Student Paper Competition Award, 34th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, 2012.
- Doctoral Research Scholarship, Fonds de Recherche du Québec Nature et Technologies (FRQNT), 2011-2012.
- Best Presentation in Session Award, American Control Conference (ACC), 2010.
- Finalist, Best Master's Thesis Award, Faculty of Engineering and Computer Science, Concordia University (only one thesis is nominated by each department), 2009.
- Max Stern Recruitment Fellowship, McGill University, 2009.
- Recruitment Award, Department of Biomedical Engineering, McGill University, 2009.
- Concordia University International Tuition Fee Remission Awards, 2008-2009.

## PUBLICATIONS.....

### JOURNAL ARTICLES:

10. **Kian Jalaeddini**<sup>§</sup>, Akira Nagamori<sup>§</sup>, Christopher M. Laine, Mahsa A. Golkar, Robert E. Kearney, Francisco J Valero-Cuevas, “Physiological Tremor Increases when Skeletal Muscle is Shortened: Implications to Fusimotor Control”, *Journal of Physiology*, (under preparation).
9. Mahsa A. Golkar, **Kian Jalaeddini** and Robert E. Kearney, “Accurate Identification of sEMG-Torque Dynamics Requires Closed-loop Methods”, *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, (submitted, under review).
8. Ferdinand von Walden, **Kian Jalaeddini**, Björn Evertsson, Johanna Friberg, Francisco J. Valero-Cuevas, Eva Pontén, “Forearm flexor muscles in children with cerebral palsy are weak, thin and stiff”, *Frontiers in Computational Neuroscience*, (in press).
7. E. Sobhani Tehrani, **Kian Jalaeddini** and Robert E. Kearney, “Ankle Joint Intrinsic Dynamics is more Complex than a Mass-Spring-Damper Model”, *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, (in press).
6. **Kian Jalaeddini**, Mahsa A. Golkar and Robert E. Kearney, “Measurement of Dynamic Joint Stiffness from Multiple Short Data Segments”, *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, (in press).
5. **Kian Jalaeddini**, Chuanxin Minos Niu, Suraj Chakravarthi Raja, Won Joon Sohn, Gerald E. Loeb, Terence D. Sanger, Francisco J. Valero-Cuevas, “Neuromorphic Meets Neuromechanics, Part II: The Role of Fusimotor Drive”, *Journal of Neural Engineering*, (in press).
4. Chuanxin Minos Niu, **Kian Jalaeddini**, Won Joon Sohn, John Rocamora, Terence D. Sanger, Francisco J. Valero-Cuevas, “Neuromorphic Meets Neuromechanics, Part I: The Methodology and Implementation”, *Journal of Neural Engineering*, (in press).
3. **Kian Jalaeddini** and Ehsan Sobhani Tehrani and Robert E. Kearney, “A Subspace Approach to the Structural Decomposition and Identification of Ankle Joint Dynamic Stiffness”, *IEEE Transactions on Biomedical Engineering*, (in press).
2. **Kian Jalaeddini** and Robert E. Kearney, “Subspace Identification of SISO Hammerstein Systems: Application to Stretch Reflex Identification”, *IEEE Transactions on Biomedical Engineering*, vol. 60, no.10, pp. 2725-2734, 2013.
1. **Kian Jalaeddini**, Kaveh Moezzi, Amir G. Aghdam, Mehdi Alasti, and Vahid Tarokh, “Rate Assignment in Wireless Networks: Stability Analysis and Controller Design”, *IEEE Transactions on Control Systems Technology*, vol. 21, no. 2, pp. 521-529, 2013.

§ equal contribution.

#### FULL-LENGTH, PEER-REVIEWED, CONFERENCE ARTICLES:

19. **Kian Jalaeddini** and Mahsa A. Golkar and Diego Guarin Lopez and Ehsan Sobhani Tehrani and Robert E. Kearney, “Parametric Methods for Identification of Time-Invariant and Time-Varying Joint Stiffness Models”, in Proceedings of 37th IFAC Symposium on System Identification, Beijing, China, pp. 1375-1380, October 2015.
18. Ehsan Sobhani Tehrani and Mahsa A. Golkar and Diego Guarin Lopez and **Kian Jalaeddini** and and Robert E. Kearney, “Methods for the Identification of Time-Varying Hammerstein Systems with Applications to the Study of Dynamic Joint Stiffness”, in Proceedings of 17th IFAC Symposium on System Identification, Beijing, China, pp. 1023-1028, October 2015.

17. Mahsa A. Golkar, **Kian Jalaeddini**, Ehsan Sobhani Tehrani and Robert E. Kearney, “Identification of Time-Varying Dynamics of Reflex EMG in the Ankle Plantarflexors During Time-Varying, Isometric Contractions”, in Proceedings of Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Milan, Italy, pp. 6744-6747, August 2015.
16. **Kian Jalaeddini** and Robert E. Kearney, “Identification of Ankle Joint Stiffness from Short Segments of Data: Application to Passive Dynamics during Movement”, in Proceedings of 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Chicago, USA, pp. 3284-3287, August 2014.
15. Ehsan Sobhani Tehrani, **Kian Jalaeddini** and Robert E. Kearney, “Identification of Ankle Joint Stiffness During Passive Movements - A Subspace Linear Parameter Varying Approach”, in Proceedings of 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Chicago, USA, pp. 1603-1606, August 2014.
14. **Kian Jalaeddini** Robert E. Kearney, “Subspace Method Decomposition and Identification of the Parallel-cascade Model of Joint Stiffness: Theory and Simulation”, in Proceedings of 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Osaka, Japan, pp. 5071-5074, July 2013.
13. Mina Ranjbaran, **Kian Jalaeddini**, Diego L. Guarin, Robert E. Kearney and Henrietta L. Galiana “Analysis and Modeling of Noise in Biomedical Systems”, in Proceedings of 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Osaka, Japan, pp. 997-1000, July 2013.
12. Diego L. Guarin, **Kian Jalaeddini** and Robert E. Kearney “Identification of a Parametric, Discrete-time Model of Ankle Stiffness”, in Proceedings of 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Osaka, Japan, pp. 5065-5070, July 2013.
11. Ehsan Sobhani Tehrani, **Kian Jalaeddini** and Robert E. Kearney, “Linear Parameter Varying Identification of Ankle Joint Intrinsic Stiffness during Imposed Walking Movements”, in Proceedings of 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Osaka, Japan, pp. 4923-4927, July 2013.
10. Ehsan Sobhani Tehrani, **Kian Jalaeddini** and Robert E. Kearney, “A Novel Algorithm for Linear Parameter Varying Identification of Hammerstein Systems with Time-Varying Nonlinearities”, in Proceedings of 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Osaka, Japan, pp. 4928-4932, July 2013.
9. **Kian Jalaeddini**, David T. Westwick and Robert E. Kearney, “Subspace Identification of Hammerstein Systems Using B-Splines”, in Proceedings of 34th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, San Diego, pp. 3316-3319, August-September 2012.
8. **Kian Jalaeddini**, Ferryl Alley and Robert E. Kearney, “Identification of Hammerstein Systems from Short Transients of Data: Application to Stretch Reflex Identification”, in Proceedings of 16th IFAC Symposium on System Identification, Brussels, Belgium, pp. 798-803, July 2012.

7. **Kian Jalaeddini** and Robert E. Kearney, “Estimation of the Gain and Threshold of the Stretch Reflex with a Novel Subspace Identification Algorithm”, in Proceedings of 33rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Boston, USA, pp. 4431-4434, August-September 2011.
6. **Kian Jalaeddini** and Robert E. Kearney, “An Iterative Algorithm for the Subspace Identification of SISO Hammerstein Systems”, in Proceedings of 18th World Congress IFAC, Milano, Italy, pp. 11779-11784, August-September 2011.
5. **Kian Jalaeddini** and Robert E. Kearney, “An Identification Algorithm for Hammerstein Systems Using Subspace Method”, in Proceedings of 2011 American Control Conference, San Francisco, USA, pp. 4793-4797, June-July 2011.
4. **Kian Jalaeddini**, Kaveh Moezzi and Amir G. Aghdam, “Stability of IS-856 CDMA Networks with non-Fully Buffered Users: A Fair Rate Allocation Strategy”, in Proceedings of 49th IEEE Conference on Decision and Control, Atlanta, USA, pp. 6439-6444, December 2010.
3. **Kian Jalaeddini** and Amir G. Aghdam, “Elimination of Limit Cycles in Wireless Networks using Three-Level Comparators”, in Proceedings of 2010 American Control Conference, Baltimore, USA, pp. 1847-1849, June-July 2010.
2. Kaveh Moezzi, **Kian Jalaeddini**, Amir G. Aghdam, Mehdi Alasti and Vahid Tarokh, “An Adaptive Rate Assignment Strategy for CDMA2000 IS-856 Subject to RAB Delay”, in *Proceedings of IEEE Global Communications Conference*, Honolulu, Hawaii, USA, November-December 2009.
1. **Kian Jalaeddini**, Kaveh Moezzi, Amir G. Aghdam, Mehdi Alasti and Vahid Tarokh, “Controller Design for Rate Assignment in Wireless Networks”, in *Proceedings of IEEE International Conference on Communications*, Dresden, Germany, June 2009.

#### INVITED ORAL PRESENTATIONS:

1. **Kian Jalaeddini**, and Francisco Valero-Cuevas, “Using a Neuromorphic System to Understand Fusimotor Drive”, XXI Congress of the International Society of Electrophysiology and Kinesiology, July 2016, Chicago, USA.

#### POSTER PRESENTATIONS:

14. **Kian Jalaeddini**, Akira Nagamori, Christopher M. Laine, Mahsa A. Golkar, Robert E. Kearney, Francisco J Valero-Cuevas, “Evidence That Tuning of Muscle Spindles Can Be Decoupled from Muscle Activation”, Annual Meeting of the American Society of Biomechanics, August 2017, Boulder, USA.
13. Akira Nagamori, Christopher M. Laine, **Kian Jalaeddini**, Francisco J Valero-Cuevas, “Interactions between tendon stiffness and spindle afferent feedback determine the magnitude of involuntary force variability”, Annual Meeting of the American Society of Biomechanics, August 2017, Boulder, USA.
12. Brian Cohn, **Kian Jalaeddini**, Francisco J Valero-Cuevas, “Neuromechanical Implications of Postural Changes to Motor Learning and Performance”, Annual Meeting of the American Society of Biomechanics, August 2017, Boulder, USA.

11. Ali Marjaninejad, Babak Taherian, **Kian Jalaeddini**, Francisco J Valero-Cuevas, “Simple and Two-Element Hill-Type Muscle Models Cannot Replicate Realistic Muscle Stiffness”, Annual Meeting of the American Society of Biomechanics, August 2017, Boulder, USA.
10. **Kian Jalaeddini**, Ali Marjaninejad, Suraj Chakravarthi Raja, Francisco Valero-Cuevas, “Changes in Fusimotor Parameters Suffice to Explain Position Thresholds, Velocity Thresholds, and Gains of the Stretch Reflex; But Produce Strong Interactions Among Them”, Annual Meeting of the Society for Neuroscience, November 2016, San Diego, USA.
9. Manu Srinath Halvagal, Suraj Chakravarthi Raja, **Kian Jalaeddini**, and Francisco Valero-Cuevas, “Inverse Modeling of the Muscle Spindle”, Viterbi-India scholarship program’s poster presentation, July 2016, Los Angeles, USA.
8. Akira Nagamori, Christopher Laine, **Kian Jalaeddini**, Francisco Valero-Cuevas, “A closed-loop neuromuscular simulation can provide insights into the origins and task-dependencies of force fluctuations” XXI Congress of the International Society for Electrophysiology and Kinesiology, July 2016, Chicago, USA.
7. **Kian Jalaeddini**, Victor Barradas, Chuanxin M. Niu, Robert E. Kearney, and Francisco Valero-Cuevas, “Identification of Dynamic Stiffness: From the Ankle to a Neuromorphic Joint”, 25th Annual Neural Control of Movement (NCM) Meeting, April 2015, Charleston, USA.
6. **Kian Jalaeddini**, Diego L. Guarin and Robert E. Kearney “Comparison of Three Methods for Identification of Ankle Joint Stiffness Model”, Biomedical Engineering Symposium, September 2013, Montreal, Canada.
5. Diego L. Guarin, **Kian Jalaeddini** and Robert E. Kearney “Identification of a Parametric, Discrete-time Model of Ankle Stiffness”, Biomedical Engineering Symposium, September 2013, Montreal, Canada.
4. Christopher Lang, **Kian Jalaeddini** and Robert E. Kearney “Identification of the Parallel-Cascade Model of Ankle Joint Stiffness Using Short Segments of Data: Application to Upright Standing Dynamics”, Biomedical Engineering Symposium, September 2013, Montreal, Canada.
3. **Kian Jalaeddini** and Robert E. Kearney, “Subspace Method Decomposition and Identification of the Parallel-cascade Model of Joint Stiffness: Theory and Simulation”, Sensing Motion for Action, Jul 2013, Montreal, Canada.
2. Ehsan Sobhani Tehrani, **Kian Jalaeddini** and Robert E. Kearney, “A Novel Algorithm for Linear Parameter Varying Identification of Hammerstein Systems with Time-Varying Nonlinearities ”, Sensing Motion for Action, Jul 2013, Montreal, Canada.
1. **Kian Jalaeddini**, Ehsan Sobhani-Tehrani, Robert E. Kearney, “Characterization of the Nonlinearity in Ankle Reflex Stiffness Dynamics”, 22nd Annual Neural Control of Movement (NCM) Meeting, April 2012, Venice, Italy.

## PROFESSIONAL ACTIVITIES.....

### PROGRAM COMMITTEE:

- Pre-Congress Workshop “The role of afferent feedback in generating our most rapid motor responses”, XXI Congress of the International Society of Electrophysiology and Kinesiology, July 2016.
- IEEE International Humanitarian Technology Conference, June 2014.
- BioMedical Engineering Symposium, September 2013.
- IEEE Montréal Section *Annual General Meeting* (AGM), 2009-2013.
- System Biology Symposium, May 2013.
- 25<sup>th</sup> IEEE Canadian Conference on Electrical and Computer Engineering, 2012.
- BioEngineering Symposium, September 2011.
- 4<sup>th</sup> Annual CANEUS IEEE Fly-By-Wireless workshop, 2011.
- IEEE Electrical Power and Energy Conference, 2009.
- Mini-symposium on Advances in Control Technology, November 2008, Concordia University.
- Mini-conference in celebration of the achievements of the Faculty of Engineering and Computer Science of Concordia University, May 2008.

#### INVITED REFEREE:

- **Reviewer of** the Journal of Physiology, Arabian Journal for Science and Engineering, Neural Computing and Applications, Applied Mathematical Modelling, International Journal of Systems Science, IEEE Journal of Biomedical and Health Informatics, PLOS ONE.
- **Reviewer of** IFAC World Congress, International Conference on Robotics and Automation, IEEE Conference on Decision and Control, IFAC Symposium on System Identification, IEEE Conference on Decision and Control and European Control Conference, IEEE Canadian Conference on Electrical and Computer Engineering.

#### PROFESSIONAL MEMBERSHIPS:

- Member of IEEE Engineering in Medicine and Biology, 2011-present.
- Member of IEEE Control System Society, 2010-2015.
- Member of IEEE Communications Society, 2009-2015.
- Member of IEEE, 2008-present.

#### SERVICES TO PROFESSIONAL COMMUNITY:

- Judge, Grodins Symposium, USC, Los Angeles, 2017.
- Chair, Engineering in Medicine and Biology (EMB) Chapter, IEEE Montréal Section, 2011-2015.

- Website/Publicity, IEEE Montréal Section, 2013-2014.
- Secretary, IEEE Montréal Section, 2011-2012.
- VP Communication, BMESS, McGill University, 2010-2013.
- Officer of Membership Development Committee, IEEE Montréal section, 2008-2010.

## OUTREACH.....

- Volunteer in USC Viterbi Robotics Open House, 2017.
- Volunteer in USC Viterbi Robotics Open House, 2016.
- Volunteer in McGill Faculty of Medicine Open House, 2011.

## REFERENCES.....

- Professor Francisco Valero-Cuevas, valero@usc.edu.
- Professor Robert Kearney, robert.kearney@mcgill.ca.
- Professor Amir Aghdam, aghdam@ece.concordia.ca.
- Professor Henrietta Galiana, henrietta.galiana@mcgill.ca.