

# Azadeh Yadollahi, Ph.D.

Curriculum Vitae  
September, 2011

## Personal Information

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**Address** Toronto Rehab Institute, 550 University Ave., 12<sup>th</sup> floor, Sleep Lab,  
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## Occupation

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**03/2011-now** Post-doctoral fellow at  
Institute of Biomaterial & Biomedical Engineering, University of  
Toronto,  
Toronto Rehab Institute, Sleep Lab.

## Academic Background

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**2005-2011** Ph.D., University of Manitoba, Department of Electrical and  
Computer Engineering.

**2002-2005** M.Sc. student in Sharif University of Technology, Electrical  
Engineering Department (Biomedical Engineering).

**1996-2001** B.Sc. Student in Sharif University of Technology, Electrical  
Engineering Department (Control Engineering).

## Research Interests

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Respiratory sounds analysis.  
Acoustical sleep apnea detection and monitoring.  
Medical image processing.

Swallowing sounds analysis.

## Computer Skills

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Professional in LabView.  
Professional in Matlab.  
C++ programming.

## Awards and Honors

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<b>2011</b>	Philips Young Investigator Award (first place) for the paper presented in IEEE-EMBS conference, Boston, 2011.
<b>2007, 2009- 2011</b>	Elizabeth Anne Hogan Memorial Scholarship (4 years),
<b>2007-2011</b>	Edward R. Toporeck Graduate Fellowship in Engineering (5 years),
<b>2010</b>	Berdie & I Cohen Fellowship in Engineering,
<b>2007-2010</b>	Telecommunication Research Labs (TRLabs) Scholarship (4 years).
<b>2006</b>	University of Manitoba International Graduate Student Scholarship (IGSS),
<b>2005</b>	Geographical IEEE/EMBS student paper competition award from Africa/Middle. East region,
<b>2002</b>	Placed 61th in the national M.Sc. examination for biomedical engineering.
<b>1996</b>	Placed 27th in the national university entrance examination among more than 250,000 participants.
<b>1995</b>	Placed 3rd in the national scientific festival of Khwarizmi.

## Patents

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1. Z. Moussavi, **A. Yadollahi**, Sergio Camorlinga. *Breathing sound analysis for detection of sleep apnea/hypopnea events*, US Patent No: 7559903.

2. Z. Moussavi, **A. Yadollahi**. *Breathing sound analysis for estimation of airflow rate*, Pending.
3. Z. Moussavi, **A. Yadollahi**. *Sleep apnea monitoring and diagnosis based on pulse oximetry and tracheal sound analysis*, Pending.

## Publications

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### Journal Papers

1. **A. Yadollahi**, Z. Moussavi, Relationship between tracheal sound and airflow in patients with sleep apnea during wake and sleep, submitted to IEEE Transaction on Biomedical Engineering, 2011.
2. **A. Yadollahi**, Z. Moussavi, The Effect of Anthropometric Variations on Acoustical Flow Estimation: Proposing a Novel Approach for Flow Estimation Without the Need for Individual Calibration, IEEE Transaction on Biomedical Engineering, Vol. 58, No. 6, pp.1663-7, 2011.
3. **A. Yadollahi**, E. Giannouli, Z. Moussavi, Sleep apnea monitoring and diagnosis based on tracheal respiratory sounds and pulse oximetry, Medical & Biological Engineering & Computing, Vol. 48, No. 11, pp. 1087-1097, 2010.
4. **A. Yadollahi**, Z. Moussavi, Automatic Breath and Snore Sounds Classification from Tracheal Sounds Recordings, Medical Engineering and Physics, Vol. 32, pp. 985-990, 2010.
5. **A. Yadollahi**, A. Ashtari, A.B. Gumel. *An  $O(h^2 + l^2)$  Method for Second-Order Hyperbolic Equations with Time-Dependent Boundary Conditions*. International Journal of Applied Mathematics and Engineering Sciences, Vol. 3, No 1, pp. 51-74, 2009.
6. **A. Yadollahi**, Z. Moussavi. *Respiratory Sounds Compression*, IEEE Transactions on Biomedical Engineering, Vol. 55, No. 4, pp. 1336 - 1343, April 2008.
7. **A. Yadollahi**, Z. Moussavi. *Acoustical Flow Estimation: Review and Validation*, IEEE Engineering in Medicine and Biology Magazine, Vol. 26, No. 1, pp. 56-61, January 2007.
8. **A. Yadollahi**, Z. Moussavi. *A Robust Method for Heart Sound Localization using Lung Sounds Entropy*, IEEE Transactions on Biomedical Engineering, Vol. 53, No. 3, pp. 497-502, March 2006.
9. **A. Yadollahi**, Z. Moussavi. *A Robust Method for Estimating Respiratory Flow Using Tracheal Sounds Entropy*, IEEE Transactions on Biomedical Engineering, Vol. 53, No. 4, pp. 662-668, April 2006.
10. **A. Yadollahi**, Z. Moussavi, M.B. Shamsollahi, Z. Ahmadinejad. *Heart sound localization using lung sounds entropy*, International Journal of Scientific Research (IJSR), Vol. 16, pp. 107-111, 2006.

### Conference Papers

1. **A. Yadollahi**, Z. Moussavi. *Detailed analysis of the relationship between tracheal breath sounds and airflow in relation to OSA during wake and sleep*, IEEE-EMBS, 2011, Boston, MA.
2. **A. Yadollahi**, Z. Moussavi. The relationship between tracheal sounds and flow in OSA patients during sleep, *Sleep*, Minneapolis, MN. June 2011.
3. **A. Yadollahi**, Z. Moussavi. Formant Analysis of Snore Sounds in Simple Snorers and OSA Patients, *Sleep*, June 2010.
4. **A. Yadollahi**, Z. Moussavi. *Acoustic Obstructive sleep apnea detections*, IEEE-EMBS, 2009, Minneapolis, MN.
5. **A. Yadollahi**, Z. Moussavi. *Formant Analysis of Breath and Snore Sounds Signals*, IEEE-EMBS, 2009, Minneapolis, MN.
6. **A. Yadollahi**, Z. Moussavi. *On Arithmetic Misconceptions of Spectral Analysis of Biological Signals, in Particular Respiratory Sounds*, IEEE-EMBS, 2009, Minneapolis, MN.
7. **A. Yadollahi**, Z. Moussavi. *Comparison of Flow-Sound Relationship for Different Features of Tracheal Sound*, IEEE EMBS, pp. 805 – 808, 2008, Vancouver.
8. **A. Yadollahi**, Z. Moussavi. *A Model Based on Wavelet Analysis for Normal Swallowing*, CCECE, pp. 000827 – 000830, 2008, Niagara Falls.
9. S. Huq, **A. Yadollahi**, Z. Moussavi. *Breathe Analysis of Respiratory Flow using Tracheal Sounds*, 7th IEEE International Symposium on Signal Processing and Information Technology, ISSPIT, pp. 414 – 418, 2007, Cairo, Egypt.
10. **A. Yadollahi**, Z. Moussavi. *Feature selection for swallowing sounds classification*, IEEE-EMBS, pp. 3172 – 3175, Aug. 2007, Lyon, France.
11. **A. Yadollahi**, Z. Moussavi. *Apnea Detection by Acoustical Means*, IEEE-EMBS, pp. 4623-4626, Sept. 2006.
12. **A. Yadollahi**, Z. Moussavi, P. Yahampath. *Adaptive Compression of Respiratory and Swallowing Sounds*, IEEE-EMBS, pp. 517-520, Sept. 2006.
13. **A. Yadollahi**, Z. Moussavi. *Robust Respiratory Flow Estimation Using Statistical Properties of Tracheal Sounds*, IEEE-EMBS, pp. 4220 – 4223, Shanghai, China, September 1-4, 2005.
14. **A. Yadollahi**, Z. Moussavi. *Measuring Minimum Critical Flow for Normal Breath Sounds*, IEEE-EMBS, pp. 2726 – 2729, Shanghai, China, September 1-4, 2005.
15. **A. Yadollahi**, M.B. Shamsollahi, Z. Moussavi and Z. Ahmadinejad. *Performance Comparison Of Different Methods For Heart Sounds Localization*, Summer Bioengineering Conference, CO, USA, 2005.
16. M. Hoviattalab, R. Narimani, **A. Yadollahi**, A. Abadpour. *New Image-based System for Vibration Measurement Specially Developed for Forced Human Vibration Analysis*, In the ASME International Mechanical Engineering Congress and RD&D Expo, (IMECE2004), Anaheim, California, November 13-19, 2004.
17. R. Narimani, M. Hoviattalab, A. Abadpour, **A. Yadollahi**. *Vibration Measurement And Analysis Using Image Processing Method*, In the proceedings of the 7th Biennial Conference on Engineering Systems Design and Analysis, (ESDA), Manchester, UK, July 19-22, 2004.

18. R. Fazel, **A. Yadollahi**. *Texture classification using multi-fractal dimension*, in the 12th Iranian Conference on Electrical Engineering (ICEE2004), Mashhad, Iran, May 2004.
19. A. Abadpour, **A. Yadollahi**. *Developing a Software Platform to Use Anaglyph Glasses for 3D Visualization*. National Computer Conference (NCC2003), Mashhad, Iran, 2003.
20. R. Narimani , A. Irajizad A, M. Atari M, **A. Yadollahi**. *Design and Development of an Optical Pressure Measurement System*. Proceedings of ISME, Tehran, Iran, pp. 603-609, 2000.

## Technical Reports

1. A. Amirfazli, K. Khoshi, **A. Yadollahi**, A. Abadpour, *Converting Industrial Drawings Type A to Type E from Non-Vector Form to Vector Form II.*, Research Proceedings, Sharif University of Technology 2000-2001, pp. 31-39.
2. A. Amirfazli, K. Khoshi, **A. Yadollahi**, A. Abadpour, *Converting Industrial Drawings Type A to Type E from Non-Vector Form to Vector Form I*, Research Proceedings, Sharif University of Technology 1999-2000, pp. 25-36.

## Invited Talks

1. Relationship between Tracheal Sound and Airflow, August 2008, iCAPTURE Centre, University of British Columbia, Canada.
2. On Arithmetic Misconceptions of Spectral Analysis of Biological Signals, in Particular Respiratory Sounds, IEEE-EMBS Chapter, April 2008. University of Manitoba, Canada.
3. Respiratory Sounds Compression, IEEE-EMBS Chapter, October 2007. University of Manitoba, Canada.
4. Robust Flow Estimation Using Tracheal Sounds Entropy, IEEE-EMBS Chapter, November 2004. University of Manitoba, Canada.

## Dissertations

1. Respiratory Sound Analysis for Flow Estimation During Wakefulness and Sleep, and it's Applications for Sleep Apnea Detection and Monitoring, 2004-2005, Sharif University of Technology, Electrical Engineering Department, M.Sc. thesis. Academic supervisor: Prof. Zahra Moussavi. Advisory committee: Prof. Attahiru S. Alfa, Dr. Jeffery Fredberg, Prof. Mirek Pawlak, Dr. Newman Stephens.

2. Respiratory sounds analysis in order to reduce heart sounds and estimate flow, 2004-2005, Sharif University of Technology, Electrical Engineering Department, M.Sc. thesis.  
Academic advisors: Prof. M.B. Shamsollahi, Prof. Z. Moussavi and Dr. Z. Ahmadinejad.
3. Vector control simulation of induction machines. 2000-2001, Sharif University of Technology, Electrical Engineering Department, B.Sc. thesis.  
Academic advisor: Prof. M.R. Zolghadri.

## Professional Memberships

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<b>2010-now</b>	Student member of American Academy of Sleep Medicine (AASM).
<b>2004-now</b>	Student member of IEEE Engineering in Medicine and Biology Society (EMBS)
<b>2007</b>	Member of the Canadian Medical and Biological Engineering Society (CMBES)

## Academic Volunteer Experience

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<b>9/2007-4/2008</b>	Treasurer of University of Manitoba Iranian Students' Association (UMISA)
<b>1998</b>	Head of the organizer committee of the first National Student Conference on Electrical Engineering execution team

## Work Experience

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### Research Experience

<b>3/2010-8/2010</b>	<i>Investigating the mechanisms of sound generation in trachea and the flow-sound relationship , Visiting Scholar, Harvard University, School of Public Health, Supervisor: Dr. J. Fredberg</i>
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- 2005-2010** *Swallowing Sound Analysis*, Biomedical Engineering Lab., University of Manitoba, Supervisor: Dr. Z. Moussavi.
- 8/2004-12/2004** *Respiratory Sound Analysis*, Biomedical Engineering Lab., University of Manitoba, Supervisor: Dr. Z. Moussavi.
- 2002** *Developing software for 3D surface reconstruction of mechanical car parts*, Internship between Sharif University of Technology and SAPCO, Supervisor: Dr. F. Farahmand.
- 2002** *Developing an image processing based 3D motion analyzer software*, Biomechanics Lab, Sharif University of Technology, Supervisors: Dr. F. Farahmand, R. Narimani.
- 2001-2002** *Developing an image-processing application human body parts vibration measurement using frames captured by a camera*, Biomechanics Lab, Sharif University of Technology, Supervisors: R. Narimani, M. Hoviat Talab.
- 2001-2002** *Developing an image-processing package for 3D reconstruction of human body parts using MRI/CT slices in DICOM format with OpenGL support for 3D visualization*, Biomechanics Lab, Sharif University of Technology, Supervisors: Dr. F. Farahmand, R. Narimani.
- 2000** *Developing an image processing based Pedobarography software for pressure analysis in biomedical applications*, Biomechanics Lab, Sharif University of Technology, Supervisors: Dr. F. Farahmand, R. Narimani.
- 1999-2000** *Developing an image-processing application for converting hard-copy drawings to vector form*, Sharif University of Technology, Supervisor: Dr. A. Amirfazli.
- 1998-1999** *Developing a 2D motion analyzer system containing image processing software for human body motion analysis using passive markers*, Biomechanics Lab, Sharif University of Technology, Supervisors: Dr. F. Farahmand, R. Narimani.

## Teaching Experience

- Fall 2010** Biomedical Instrumentation and Signal Processing, University of Manitoba. Instructor.

<b>Fall 2008</b>	Biomedical Instrumentation and Signal Processing, University of Manitoba. Teacher assistant.
<b>Fall 2007</b>	Biomedical Instrumentation and Signal Processing, University of Manitoba. Teacher assistant.
<b>Fall 2007</b>	Biomedical Instrumentation and Signal Processing, University of Manitoba. Teacher assistant.
<b>Winter 2007</b>	Biomedical Instrumentation and Signal Processing, University of Manitoba. Teacher assistant.
<b>Fall 2006</b>	Digital Signal Processing, University of Manitoba. Teacher assistant.
<b>Fall 2006</b>	Control Systems, University of Manitoba. Teacher assistant.
<b>Summer 2006</b>	Introduction to Electrical and Computer Engineering, and redesign the course labs, University of Manitoba. Teacher assistant.
<b>Summer 2006</b>	Digital Control, University of Manitoba. Teacher assistant.
<b>Winter 2006</b>	Numerical Methods, University of Manitoba. Teacher assistant.
<b>Winter 2004</b>	Biological Systems Modeling, Sharif University of Technology. Teacher assistant.
<b>Summer 2004</b>	Logic circuits, Sharif University of Technology. Teacher assistant.

## Industry Experience

<b>2002</b>	Pipe hydroteser automation using an OMRON CQM1H PLC for a fully automated pipe hydroteser testing 3 pipes at the same time as the DIN standard rules, Installed in Sepehan Saghf, Esfahan, Karband Eng. Co., Tehran.
<b>2001</b>	Developing a strain gauge readout utility. Carador Co. Ltd., Tehran.
<b>2001</b>	Pipe end facing automation using an OMRON CPM2A 60CDR PLC, Installed in Sepehan Saghf, Esfahan, Carador Co. Ltd., Tehran.

- 2000 Design and development of a gluing robot with three degrees of freedom, used for gluing car glass lifting motor parts (Pride), tracking several curves in X-Y plane using two step-motors, Installed in Shahab Shams Co., Carador Co. Ltd., Tehran.
- 2000 Developing software for a 80196MH.based inverter for AC motors up to 110KW. Carador Co. Ltd., Tehran.
- 2000 Design and development of a DC motor endurance test and characteristic curve estimation, Installed in SAPCO, Carador Co. Ltd., Tehran.
- 1999 Design and development of a commercial digital soft starter for AC motors up to 20Kw, Carador Co. Ltd., Tehran.
- 1999 Developing a 89C51.based control system for wire industry automation, Installed in Alomtek Co., Carador Co. Ltd., Tehran.

## Referees

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### I. Zahra Moussavi,

Professor & Canada Research Chair,  
 Department of Electrical and Computer Engineering,  
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 URL: <http://www.ee.umanitoba.ca/~moussavi>.

### II. T. Douglas Bradley

Senior Scientist at Toronto Rehab and Director of the hospital's Sleep Research Laboratory. Professor of Medicine at the University of Toronto and Director of the university's Centre for Sleep Medicine and Circadian Biology. Respiriologist and Sleep Medicine specialist at Toronto General Hospital and Mount Sinai Hospital.  
 Toronto General Hospital – UHN, 9N-943, 200 Elizabeth Street  
 Toronto, ON. , CANADA, M5G 2C4  
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### III. Geoffrey Fernie

Vice President, Research at Toronto Rehab. Professor in the Department of Surgery at the University of Toronto.  
 Toronto Rehabilitation Institute

Suite 12028, 550 University Avenue,  
Toronto, ON., CANADA, M5G 2A2  
email: fernie.geoff@torontorehab.on.ca

**IV. Jeffrey Fredberg**

Professor of Bioengineering and Physiology  
Department of Environmental Health, 665 Huntington Avenue, Building I  
Room 313  
Boston, MA 02115  
Phone: 617.432.0198  
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**V. Newman Stephens**

Professor, Department of Physiology, University of Manitoba, 603 J Buhler  
Research Ctr., Winnipeg, MB, Canada.  
Phone: 204 789 3526  
email: newman\_stephens@umanitoba.ca

**VI. Attahiru S. Alfa**

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**VII. Abba B. Gumel,**

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