

# Kyoungchul Kong

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**PERSONAL INFORMATION** *Gender* Male *Nationality* South Korea  
*Date of Birth* September 22, 1981 *VISA Status* F-1 (OPT)  
*Place of Birth* South Korea

**EDUCATION** **Ph.D.** - *University of California, Berkeley* 2006 - 2009  
*Department of Mechanical Engineering*  
Dissertation Title: Mechatronic Considerations for Human Assistive and Rehabilitation Systems  
Research Advisor: Professor Masayoshi Tomizuka

**M.S.** - *Sogang University* 2004 - 2006  
*Department of Mechanical Engineering*  
Thesis Topic: Design and Control of Exoskeletal Robots for Patients and Elderly People  
Research Advisor: Professor Doyoung Jeon

**B.Eng., B.S.**, - *Sogang University* 2000 - 2004  
*Department of Mechanical Engineering (B.ENG)*  
*Department of Physics (B.S.)*  
SUMMA CUM LAUDE, With Honors in Engineering (1 out of more than 400 in Eng. Dept.)

**REFERENCE CONTACTS** **Professor Masayoshi Tomizuka**  
Department of Mechanical Engineering, University of California, Berkeley  
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**Professor Homayoon Kazerooni**  
Department of Mechanical Engineering, University of California, Berkeley  
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**Professor Roberto Horowitz**  
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**Professor Steven L. Lehman**  
Department of Integrative Biology, University of California, Berkeley  
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**Professor Tsu-Chin Tsao**  
Department of Mechanical and Aerospace Engineering, University of California, Los Angeles  
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<b>POSITIONS</b>	<b>Postdoctoral Research Associate</b> - <i>University of California, Berkeley</i>	2009 - Present
	<b>Graduate Student Researcher / Instructor</b> - <i>University of California, Berkeley</i>	2006 - 2009
	<b>Consultant</b> - <i>SEDNA Engineering Co.</i>	2009 - Present
	<b>Programmer</b> - <i>SEJONG Engineering Co.</i> Project: Design of Control Algorithms for a Vehicle Crash Test	2006
	<b>System Engineer</b> - <i>CHONGMIN Science Co.</i> Project: Development of Chemical Evaporators	2003 - 2004
	<b>Researcher</b> - <i>OXUS Co.</i> Project: Development of Oxygen Concentrators	2001 - 2003
	<b>Research Intern</b> - <i>LG Electronics Co.</i> Project: Development of New Services and Products of Network-Based Robots	2001
<b>HONORS AND AWARDS</b>	<b>Outstanding Graduate Student Instructor Award</b> <i>University of California, Berkeley</i>	2009
	<b>Best Student Paper Award</b> <i>The IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM)</i>	2008
	<b>Best Poster Finalist</b> <i>The 17<sup>th</sup> International Federation of Automatic Control (IFAC) World Congress</i>	2008
	<b>Best Student Paper Finalist</b> <i>The IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM)</i>	2005
	<b>Best Paper Award</b> <i>The Division of Dynamics and Control Systems, KSME Spring Conference</i>	2005
	<b>Best Poster Award</b> <i>The 3<sup>rd</sup> CIR (Center of Intelligent Robot) Workshop</i>	2005
	<b>Top Graduation Award</b> <i>Top graduation in the College of Engineering, Sogang University</i>	2004
<b>PROFESSIONAL MEMBERSHIPS</b>	IEEE, Member	2003 - Present
	ASME, Member	2003 - Present
	KSME (Korean Society of Mechanical Engineering), Member	2004 - Present
	ICROS (Institution of Control, Robotics, and Systems), Member	2004 - Present

**SCIENTIFIC  
SERVICE**

**Journal Referee:** IEEE Transactions on Robotics, IEEE/ASME Transactions on Mechatronics, ASME Journal of Journal of Dynamic Systems, Measurement, and Control

**Conference Referee:** IEEE International Conference on Robotics and Automation (ICRA), IEEE International Conference on Advanced Intelligent Mechatronics (AIM), ASME Dynamic Systems and Control Conference (DSCC), American Control Conference (ACC)

**Program Committee:** 2010 IEEE International Conference on Advanced Intelligent Mechatronics

**RESEARCH  
EXPERIENCES**

I have participated in the following research projects.

**Smart Shoes and Smart Socks for Abnormal Gait Diagnosis and Assistance**

*Supported by NSF, United States*

September 2006 - present

*PI: Professor Masayoshi Tomizuka*

*Co-PI: Professor Alison B. Flatau, University of Maryland, College Park*

*Professor Nancy Byl, University of California, San Francisco*

*Professor Yoshiyuki Sankai, Tsukuba University*

*Brief Description:* This research has concerned with an investigation on ground contact force (GCF) measurements and their utilization in rehabilitation of patients and in active assistive device to help people with walking problems. GCF measurements have been accomplished by utilizing sensors embedded in shoes.

**Design and Control of Exoskeletons for Patients and Elderly People**

*Supported by Ministry of Knowledge and Economy, Korea*

November 2003 - August 2006

*PI: Professor Doyoung Jeon*

*Co-PI: Professor Duk Hyun Sung, Samsung Medical Center*

*Brief Description:* This research has focused on the development of assistive robots for patients and elderly people. Human-interactive control systems, robot system design, and sensing technologies are included in the major topics of this research.

**Biopsy Tools for Capsule Endoscopes**

*Supported by Ministry of Knowledge and Economy, Korea*

July 2003 - February 2006

*PI: Professor Doyoung Jeon*

*Brief Description:* In this research, a biopsy module, which is integrated in capsule endoscopes, has been studied. The prototypes are fabricated by MEMS technology.

**Design of High Precision Controller for Multi-Purpose Machining Tools**

*Supported by Ministry of Knowledge and Economy, Korea*

July 2004 - August 2006

*PI: Professor Doyoung Jeon*

*Brief Description:* This research has studied on the control of a customized machining tool actuated by a linear motor. Dynamic stiffness enhancement, repetitive error rejection, and automatic gain tuning are included in the major topics of this research.

**Control of a Nano-Stage Based on Piezo Actuators**

*Supported by Jiutec. Co.*

March 2004 - December 2005

*PI: Professor Doyoung Jeon*

*Brief Description:* Control of a flexure stage actuated by piezo actuators is the main topic. Preview control and model following control have been studied in this research.

**RESEARCH EXPERIENCES**      **Control of a Seat Suspension System Using MR Dampers**      November 2004 - October 2005  
*supported by Sogang University*  
*PI: Professor Doyoung Jeon*  
 (Continued)      *Brief Description: A seat suspension system has been developed to suppress the vibration of a driver seat in vehicles. The control of a magneto-rheological fluid (MRF) damper is the main approach of this research.*

**TEACHING EXPERIENCES**      I have served as a teaching assistant in the following classes.

<b>Advanced Control Systems I - University of California, Berkeley</b> <i>TA Evaluation 4.9/5.0, Outstanding GSI Award</i> Instructor: Professor Masayoshi Tomizuka	Fall 2008
<b>Advanced Control Systems I - Sogang University</b> Instructor: Professor Doyoung Jeon	Spring 2005
<b>Digital Control - Sogang University</b> Instructor: Professor Doyoung Jeon	Spring 2005
<b>Automatic Control - Sogang University</b> Instructor: Professor Doyoung Jeon	Fall 2004

**INVITED TALKS AND SEMINARS**

- University of California, Berkeley**, September 2009, Invited Talk (Robotics and Embedded Systems Seminar), “*Mechatronics Considerations for Human Assistive and Rehabilitation Systems*”
- University of California, Los Angeles**, March 2009, Invited Talk, “*Mechatronics for Assisting Humans*”
- Korea Advanced Institution of Science and Technology**, January 2009, Invited Talk, “*Mechatronics for Assisting Humans*”
- Sogang University**, January 2009, Research Seminar, “*Computer Aided Controller Design*”
- NI-Week**, August 2008, Embedded Systems Session, “*Mechatronic Technologies for Assisting Humans*”
- NI-Week**, August 2007, *Demonstration in Keynote Presentation*
- US-Japan Workshop on Advanced Integrated Sensor Technologies for Safe and Secure Societies and Better Quality of Life**, July 2007, “*A Gait Monitoring System Based on Smart Shoes*”

**JOURNAL PUBLICATIONS**

- [1] K. KONG, H. Moon, D. Jeon, and M. Tomizuka, “Control of an Exoskeleton for Realization of Aquatic Therapy Effects,” *IEEE/ASME Transactions on Mechatronics*, To be appeared in April, 2010
- [2] K. KONG and M. Tomizuka, “Control of Exoskeletons Inspired by Fictitious Gain in Human,” *IEEE/ASME Transactions on Mechatronics*, Vol. 14, No. 6, pp. 689-698, 2009
- [3] K. KONG and M. Tomizuka, “A Gait Monitoring System Based on Air Pressure Sensors Embedded in a Shoe,” *IEEE/ASME Transactions on Mechatronics*, Vol. 13, No. 3, pp. 358-370, 2009

- [4] K. KONG, H. Moon, B. Hwang, D. Jeon, and M. Tomizuka, "Impedance Compensation of SUBAR for Back-Drivable Force Mode Actuation," *IEEE Transactions on Robotics*, Vol. 25, No. 3, pp. 512-521, 2009
- [5] K. KONG, J. Bae, and M. Tomizuka, "Control of Rotary Series Elastic Actuator for Ideal Force Mode Actuation in Human-Robot Interaction Applications," *IEEE/ASME Transactions on Mechatronics*, Vol. 14, No. 1, pp. 105-118, 2009
- [6] K. KONG and D. Jeon, "Design and Control of an Exoskeleton for the Elderly and Patients," *IEEE/ASME Transactions on Mechatronics*, Vol.11, No.4, pp. 936-942, 2006
- [7] K. KONG and D. Jeon, "Design and Control of a Novel Tendon-Driven Exoskeletal Power Assistive Device," *Journal of Control, Automation, and Systems Engineering*, Vol.11, No.11, 2005
- [8] K. KONG and D. Jeon, "Fuzzy Control of the Seat Suspension System Considering the Acceleration of a Driver's Head," *Journal of Control, Automation, and Systems Engineering*, Vol.11, No.7, pp. 572-577, 2005
- [9] K. KONG, H. C. Kniep, and M. Tomizuka, "Output Saturation in Electric Motor Systems: Identification and Controller Design," *ASME Journal of Dynamic Systems, Measurement, and Control*, under review
- [10] J. Bae, K. KONG, and M. Tomizuka, "A Mobile Gait Monitoring System for Abnormal Gait Diagnosis and Rehabilitation," *IEEE/ASME Transactions on Mechatronics*, under review
- [11] K. KONG, J. Bae, and M. Tomizuka, "A Compact Series Elastic Actuator for Knee Joint Assistive System," *IEEE/ASME Transactions on Mechatronics*, under review
- [12] C.-H. Han, K. KONG, and M. Tomizuka, "Sensor-based Controller Tuning of Indirect Drive Trains by Real-time Optimization," *Control Engineering Practice*, under review

#### REFEREED CONFERENCE PROCEEDINGS

##### *Design and Control of Human Assistive and Rehabilitation Systems*

- [13] K. KONG and M. Tomizuka, "Realization of Fictitious Gain in Human: Experimental Verification on an Elbow Joint," in *Proceedings of the IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM)*, pp. 439-444, 2009
- [14] K. KONG, H. Moon, D. Jeon, and M. Tomizuka, "Robotic Rehabilitation Treatments: Realization of Aquatic Therapy Effects in Exoskeleton Systems," in *Proceedings of the IEEE International Conference on Robotics and Automation (ICRA)*, pp. 1923-1928, 2009
- [15] K. KONG, C. Baek, and M. Tomizuka, "Design of a Rehabilitation Device Based on Mechanical Links," in *Proceedings of the IEEE International Conference on Robotics and Automation (ICRA)*, pp. 2306-2311, 2009
- [16] K. KONG and M. Tomizuka, "Control of Exoskeletons Inspired by Fictitious Variable Gain in Human," in *Proceedings of the ASME Dynamic Systems and Control Conference (DSCC)*, No. 2116, 2008
- [17] K. KONG and D. Jeon, "Fuzzy Control of a New Tendon-Driven Exoskeletal Power Assistive Device," in *Proceedings of the IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM)*, pp. 146-151, 2005 **[Best Student Paper Finalist]**
- [18] K. KONG and D. Jeon, "Design and Control of a New Tendon-Driven Exoskeletal Lower Body Power Assistive Device," in *Proceedings of the ASME International Mechanical Engineering Congress and Exposition (IMECE)*, 2005

### Sensors, Health Monitoring, and Human Motion Detection

- [19] J. Bae, K. KONG, and M. Tomizuka, "Design of a Mobile Gait Monitoring System," in *Proceedings of the IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM)*, 2010, under review
- [20] J. Bae, K. KONG, and M. Tomizuka, "Real-time Estimation of Lower Extremity Joint Torques in Normal Gait," in *Proceedings of the International IFAC Symposium on Robot Control (SYROCO)*, pp. 577-582, 2009
- [21] J. Bae, K. KONG, and M. Tomizuka, "A Mobile Gait Monitoring System for Gait Analysis," in *Proceedings of the IEEE International Conference on Rehabilitation Robotics (ICORR)*, pp. 73-79, 2009
- [22] K. KONG and M. Tomizuka, "Estimation of Abnormalities in a Human Gait Using Sensor-Embedded Shoes," in *Proceedings of the IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM)*, pp. 1331-1336, 2008
- [23] K. KONG and M. Tomizuka, "Smooth and Continuous Human Gait Phase Detection Based on Foot Pressure Patterns," in *Proceedings of the IEEE International Conference on Robotics and Automation (ICRA)*, pp. 3678-3683, 2008

### Impedance Compensation of Actuators

- [24] K. KONG, J. Bae, and M. Tomizuka, "A Compact Rotary Series Elastic Actuator for Knee Joint Assistive System," in *Proceedings of the IEEE International Conference on Robotics and Automation (ICRA)*, Accepted
- [25] J. Bae, K. KONG, and M. Tomizuka, "Gait Phase-Based Sliding Mode Control for Rotary Series Elastic Actuator," in *Proceedings of the American Control Conference (ACC)*, Accepted
- [26] K. KONG, M. Tomizuka, H. Moon, B. Hwang and D. Jeon, "Mechanical Design and Impedance Compensation of SUBAR (Sogang University's Biomedical Assist Robot)," in *Proceedings of the IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM)*, pp. 377-382, 2008 **[Best Student Paper Award]**
- [27] K. KONG, J. Bae and M. Tomizuka, "Impedance Compensation of Flexible Joint Actuator for Ideal Force Mode Control," in *Proceedings of the 17th IFAC World Congress*, 2008 **[Best Poster Finalist]**
- [28] K. KONG, J. Bae and M. Tomizuka, "Biologically Inspired Actuator for Human-Robot Interaction," in *Proceedings of the International Symposium on Flexible Automation*, pp. 2442-2447, 2008
- [29] K. KONG and M. Tomizuka, "Flexible Joint Actuator for Patient's Rehabilitation Devices," in *Proceedings of the IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN)*, pp. 1179-1184, 2007

### Dynamic Systems and Control

- [30] W. Chen, K. KONG, and M. Tomizuka, "Hybrid Adaptive Friction Compensation of Indirect Drive Trains," in *Proceedings of the ASME Dynamic Systems and Control Conference (DSCC)*, No. 2736, 2009
- [31] K. KONG, H. Kniep, and M. Tomizuka, "Control of Electronically Commutated Motors Considering Input/Output Saturation," in *Proceedings of the ASME Dynamic Systems and Control Conference (DSCC)*, No. 2513, 2009

- [32] C.-H. Han, K. KONG, and M. Tomizuka, "Sensor-based Controller Tuning of Robot Manipulators by Real-time Optimization," in *Proceedings of the International IFAC Symposium on Robot Control (SYROCO)*, pp. 715-720, 2009
- [33] K. KONG, K. Inaba and M. Tomizuka, "Real-Time Nonlinear Programming by Amplitude Modulation," in *Proceedings of the ASME Dynamic Systems and Control Conference (DSCC)*, No. 2160, 2008
- [34] K. KONG and D. Jeon, "A Study on the Control of a Linear Motor System of the Universal Machining Center," in *Proceedings of the KSPE (Korean Society of Precision Engineering) Annual Conference*, 2005
- [35] D. Jeon and K. KONG, "Fuzzy Control of a Seat Suspension System with an MR Damper," in *Proceedings of the KSME (Korean Society of Mechanical Engineering) Fall Conference*, pp. 619-624, 2004 [**Best Paper Award**]

Micro Medical Devices for Capsule Endoscopes

- [36] K. KONG, J. Cha, D. Jeon, and D. Cho, "A Rotational Micro Biopsy Device for the Capsule Endoscope," in *Proceedings of the IEEE/RSJ International Conference on Intelligent Robotics and Systems (IROS)*, pp. 3057-3061, 2005
- [37] K. KONG and D. Jeon, "Design of a Biopsy Module for the Capsule Type Endoscope," in *Proceedings of the ASME International Mechanical Engineering Congress and Exposition (IMECE)*, 2005

**NON-REFEREED CONFERENCE PROCEEDINGS**

- [38] J. Bae , K. KONG, and M. Tomizuka, "Design of a Mobile Gait Monitoring System and Its Experimental Results," in *Proceedings of the SPIE Structures/NDE*, 2010, under review
- [39] Tomizuka, K. KONG, and J. Bae "Smart Shoes and Smart Socks for Abnormal Gait Diagnosis and Assistance," in *Proceedings of the NSF Engineering Research and Innovation Conference*, Honolulu, Hawaii, 2009
- [40] L.M. Castano, J. Bae , K. KONG, M. Tomizuka, and A.B. Flatau, "Fusion of Air Pressure Sensors and Conductive Polymer Sensors for a Multi-Functional Gait Monitoring System," in *Proceedings of Asian-Pacific Network of Centers for Research in Smart Structure Technology (ANCRiSST)*, 2009
- [41] K. KONG, J. Bae, and M. Tomizuka, "Detection of Abnormalities in a Human Gait Using Smart Shoes," in *Proceedings of the SPIE Smart Structures/NDE*, 2008
- [42] K. KONG, "Human Motion Phase Detection Based on Ground Contact Force Measurement," in *Proceedings of the US-Japan Workshop on Advanced Integrated Sensor Technologies for Safe and Secure Societies and Better Quality of Life*, Japan, 2007
- [43] K. KONG and D. Jeon, "New Design of Tendon-Driven Exoskeletal Assistive Device," in *Proceedings of the KSME (Korean Society of Mechanical Engineering) Spring Conference*, 2005
- [44] K. KONG and D. Jeon, "A Study on the Control of a New Tendon-Driven Exoskeletal Power Assistive Device," in *Proceedings of the KSME (Korean Society of Mechanical Engineering) Spring Conference*, 2005
- [45] K. KONG, J. Cha, D. Jeon, and D. Cho, "A Micro Biopsy Device for the Capsule Endoscope," in *Proceedings of the KSME (Korean Society of Mechanical Engineering) Spring Conference*, pp. 1244-1248, 2005
- [46] K. KONG, S. Lee, and D. Jeon, "Exoskeleton Systems for Assisting Elderly," in *Proceedings of the 3<sup>rd</sup> CIR*

*(Center of Intelligent Robot) Workshop, 2005*

- [47] T. Jeong, K. KONG, and D. Jeon, "Hardware Development of Exoskeleton Systems," in *Proceedings of the 2<sup>nd</sup> CIR (Center of Intelligent Robot) Workshop, 2004*
- [48] K. KONG, G. Lee, and D. Jeon, "Fuzzy Control of a Seat Suspension System with an MR Damper," in *Proceedings of the 9th International Conference of ER and MR Fluids, 2004*

## **PATENTS**

- [49] K. KONG, J. Bae, and M. Tomizuka, "Smart Shoes for Abnormal Gait Diagnosis and Assistance," *USA Patent Pending*
- [50] K. KONG and D. Jeon, "A Walking Aid for Patients' Power Augmentation and its Control Method," *Patent No: 10-0612031, Korea, 2006*
- [51] K. KONG and D. Jeon, "A Rotational Biopsy Device for Capsule Endoscopes," *Patent No: 10-0649543, Korea, 2006*
- [52] K. KONG, H. Seo, and D. Jeon, "An Intelligent Human-Power Assistive Robot," *Patent No: 10-0651637, Korea, 2006*
- [53] K. KONG, H. Seo, and D. Jeon, "A Thigh Muscle Sensor for Human-Power Assistive Devices," *Patent No: 10-0651638, Korea, 2006*
- [54] K. KONG, H. Seo, and D. Jeon, "A Foot Pressure Sensor for Human-Power Assistive Devices," *Patent No: 10-0651639, Korea, 2006*