

KIJU LEE

Nord Distinguished Assistant Professor, Department of Mechanical and Aerospace Engineering
Director, Distributed Intelligence and Robotics Laboratory
Case School of Engineering
Case Western Reserve University, Cleveland, OH 44106-7222
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EDUCATION

- Ph.D. 2008 **Mechanical Engineering, Johns Hopkins University, Baltimore, MD, USA**
Dissertation title: *Robots that Duplicate Themselves: Theoretical Principles and Physical Demonstrations*
Advisor: Prof. Gregory S. Chirikjian, Committee Members: Profs. Noah Cowan and Edward Scheinerman
- M.S.E. 2006 **Mechanical Engineering, Johns Hopkins University, Baltimore, MD, USA**
Advisor: Prof. Gregory S. Chirikjian
- B.S.E. 2002 **Electrical and Electronics Engineering, Chung-Ang University, Seoul, Korea**
Thesis topic: *4-Legged Robot Design and Control*
Advisor: Prof. Hong-Tae Jeon

RESEARCH INTEREST

Human-Robot Interactions, Sensor Networked Systems, Technology-Embedded Biomedical Devices, Sociable Robotics, Modular Robotics, Self-Replicating/Reconfigurable Robots

ACADEMIC AND PROFESSIONAL POSITIONS

- 2012-Present **Nord Distinguished Assistant Professor**
Mechanical and Aerospace Engineering, Case Western Reserve University
- 2008-Present **Assistant Professor**
Mechanical and Aerospace Engineering, Case Western Reserve University
- 2003-2008 **Graduate Research Assistant**
Department of Mechanical Engineering, Johns Hopkins University
- 2006-2007 **Teaching Assistant**
Department of Mechanical Engineering, Johns Hopkins University
EN 530.403 & EN 530.404: Senior Design Projects
EN 530.421: Mechatronics
- 2002-2003 **Electrical Engineer (Part-time)**
Borim Industry, Daegu, Korea

PUBLICATIONS

My advisees are underlined.

Refereed Journal Articles and Conference Proceedings:

- P1. D. Jeong and **K. Lee**, "InchBot: A Novel Swarm Microrobotic Platform," accepted for *the 2013 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2013)*, November 2013

- P2. G. Kaloutsakis, A. Reimer, D. Jeong, and **K. Lee**, "Design and Evaluation of a Multi-sensor Unit for Measuring Physiological Stressors of Medical Transport," accepted for *ASME 2013 International Mechanical Engineering Congress & Exposition*, November 2013
- P3. F. Bellotti, B. Kapralos, **K. Lee**, and P. Moreno-Ger, and R. Berta, "Assessment in and of Serious Games: An Overview," *Advances in Human-Computer Interaction* (2013), Article ID 136864
- P4. D. Jeong and **K. Lee**, "Directional RSS-Based Localization of Multi-Robot Applications," The 12th WSEAS International Conference on Signal Processing, Robotics, and Automation, Cambridge, UK, February 2013
- P5. Y. Zhang, K. Hornfeck, and **K. Lee**, "Adaptive Face Recognition for Low-Cost, Embedded Human-Robot Interaction," International Conference on Intelligent Autonomous Systems, Jeju, Korea, June 2012
- P6. D. Jeong, B. Floyd and **K. Lee**, "SmartBall: Toward Interactive Play for Infants," *Sixth International Conference on Tangible, Embedded, and Embodied Interaction (TEI 2012) Work-in-Progress*, Kingston, ON, Canada, February 2012.
- P7. B. Floyd, D. Jeong and **K. Lee**, "Geometric Games for Assessing Cognitive, Working Memory, and Motor Control Skills." *Sixth International Conference on Tangible, Embedded, and Embodied Interaction (TEI 2012) Work-in-Progress*, Kingston, ON, Canada, February 2012.
- P8. D. Jeong, E. Kerçi, and **K. Lee**, "TaG-Games: Tangible Geometric Games for Assessing Cognitive Problem-Solving Skills and Fine Motor Proficiency," IEEE International Conference on Multisensor Fusion and Integration, Salt Lake City, Utah, September 5-7, 2010
- P9. **K. Lee** and G. S. Chirikjian, "An autonomous Robot that Duplicates Itself from Low-Complexity Components," IEEE International Conference on Robotics and Automation, Anchorage, Alaska, May 3-8, 2010
- P10. D. Jeong, E. Kerçi, and **K. Lee**, "Sensor-Integrated Geometric Blocks: Towards Interactive Play-Based Assessment of Young Children," International Workshop on Interactive Systems in Healthcare (CHI-WISH 2010), Atlanta, GA, April 10-11, 2010
- P11. **K. Lee**, G. Kaloutsakis and J. Couch, "Towards Social-Therapeutic Robots: How to Strategically Implement a Robot for Social Group Therapy," IEEE International Symposium on Computational Intelligence in Robotics and Automation, Daejeon, Korea, December 2009
- P12. **K. Lee**, M. Moses and G.S. Chirikjian, "Robotic Self-Replication in Structured Environments: Physical Demonstrations and Complexity Measures," *International Journal of Robotics Research*, Vol. 27, Issue 3-4, pp. 387-401, March 2008
- P13. **K. Lee** and G.S. Chirikjian, "Robotic Self-Replication from Low-Complexity Parts," *IEEE Robotics and Automation Magazine*, Vol. 14, Issue 4, pp. 34-43, December 2007
- P14. **K. Lee**, Y. Wang and G.S. Chirikjian, "O(N) Mass Matrix Inversion for Serial Manipulators and Polypeptide Chains using Lie Derivatives," *Robotica*, Vol. 25, Issue 6, pp. 739-750, November 2007
- P15. **K. Lee** and G. S. Chirikjian, "Measures of Reliability and Task Complexity for Self-Replicating Robotic Systems," *International Conference on Advanced Robotics*, Jeju, Korea, August 2007, pp. 1029-1034
- P16. S. Eno, L. Mace, J. Liu, B. Benson, K. Raman, **K. Lee**, M. Moses, G.S. Chirikjian, "Robotic Self-Replication in a Structured Environment without Computer Control," *IEEE International Symposium on Computational Intelligence in Robotics and Automation*, Jacksonville, FL, June 2007, pp. 327-332
- P17. Liu, M. Sterling, D. Kim, A. Pierpont, A. Schlothauer, M. Moses, **K. Lee**, G.S. Chirikjian, "A Self-Replicating Robot with Simplified Control," *IEEE International Symposium on Assembly and Manufacturing*, Ann Arbor, Michigan, USA, July 2007, pp. 264-269

- P18. **K. Lee** and G.S. Chirikjian, “A New Perspective on $O(N)$ Mass-Matrix Inversion for Serial Revolute Manipulators,” *Proceedings of IEEE International Conference on Robotics and Automation*, Barcelona, Spain, April 2005, pp. 4722-4726
- P19. **K. Lee** and G.S. Chirikjian, “ $O(N)$ Inversion of Mass-Matrix for Hyper-Redundant Manipulators and Polymer Chains,” *Proceedings of MUSME 2005*, Uberlandia, Brazil, March 2005
- P20. W. Park, D. Albright, C. Addleston, W.K. Won, **K. Lee**, G.S. Chirikjian, “Robotics Self-Repair in a Semi-Structured Environment,” *Proceedings of Robosphere 2004*, NASA Ames, CA, November 2004

Peer-Reviewed Abstracts, Presentations and Posters:

- A1. K. Hornfeck, Y. Zhang and **K. Lee**, “Philos: A Sociable Robot for Human-Robot Interactions and Wireless Health Monitoring,” Proceedings of the 27th Symposium on Applied Computing (SAC 2012), Riva del Garda, Italy, March 26-30, 2012
- A2. D. Jeong and **K. Lee**, “Quantitative Analysis of Muscle Activations and Real-time Simulations for Two Pitching Motions: Overhand Pitching and Sidearm Pitching (Abstract),” Biomedical Engineering Society Annual Meeting 2011, October 2011
- A3. **K. Lee**, D. Jeong, B. Floyd, R. Cooper, and E. Short, “Games for Automated Assessments of Cognitive and Fine-Motor Skills: Design and Preliminary Evaluation (Abstract & Presentation),” submitted to 5th Annual International Conference on Psychology, May 2011
- A4. D. Jeong, E. Kerci, **K. Lee**, “Sensor-Integrated Geometric Blocks: Towards Interactive Play-Based Assessment of Young Children,” Research ShowCASE, Case Western Reserve University, Cleveland, OH, April 2010 (Poster)
- A5. **K. Lee**, M. Moses, M. Kutzer, “Self-Replicating Robots for Space Exploration,” *AIAA 2nd Space Exploration Conference: Future Leaders Exhibition*, Houston, TX, December 2006 (Poster)
- A6. **K. Lee**, M. Moses, G.S. Chirikjian, “Robotic Self-Replication in Structured and Adaptable Environments,” *Proceedings of Robotics: Science and Systems Workshop on Self-reconfigurable Modular Robots*, Philadelphia, August 2006
- A7. **K. Lee** and G.S. Chirikjian, “An Autonomous Self-Replicating Robot in a Partially Structured Environment,” *AIAA Region I YPSE-06*, APL, JHU, Laurel, MD, November 2006 (Abstract & Presentation)

Dissertation and Thesis:

- K. Hornfeck, “A Customizable Socially Interactive Robot with Wireless Health Monitoring Capability,” MS Thesis, Mechanical and Aerospace Engineering, CWRU, May 2011
- Y. Zhang, “Low-Cost, Real-Time Face Detection, Tracking and Recognition for Human-Robot Interactions,” MS Thesis, Mechanical and Aerospace Engineering, CWRU, May 2011
- **K. Lee**, “Robots that Duplicate Themselves: Theoretical Principles and Physical Demonstration,” Ph.D. Dissertation, Mechanical Engineering, Johns Hopkins University, Baltimore, Maryland, July 2008

Invited Talks:

- Goldbag Research Seminar, Bolton School of Nursing, Case Western Reserve University, October 18, 2010, “TaG-Games: Tangible Geometric Games for Assessing Cognitive Problem Solving and Fine Motor Proficiency.”
- OAI-CWRU Industry Day, Case Western Reserve University, October 14, 2010, “Robotics Technology for Healthcare Applications.”
- Department of Mechanical Engineering, Columbia University, New York, USA, March, 2008, “Robotic Self-replication: Complexity Measures and Physical Demonstrations.”

- Department of Electrical and Electronics Engineering, Chung-Ang University, Seoul, Korea, August 2007, “Descriptive Framework and Complexity Measures for Self-Replicating Robotic Systems.”

RESEARCH SUPPORT

Ongoing Research Support:

2011 – 2014 **Principal Investigator**

- Sponsor: National Science Foundation (Award #. 1109270)
- Title: Sensor-enabled geometric blocks for early-childhood education

This project is to develop and evaluate sensor-enabled geometric blocks and associated software for assessing cognitive, fine-motor, and working memory skills in young children.

2012 – 2013 **Principal Investigator**

- Sponsor: Clinical and Translational Science Collaborative (CTSC)
- Title: Feasibility evaluation of a customizable social robot for behavioral assessment and intervention for children with autism spectrum disorders.

This project aims to develop a low-cost social robot and clinically evaluate its functionality for assisting behavior therapy for children with autism spectrum disorders in collaboration with Cleveland Clinic’s Center for Autism.

2011 – 2014 **Co-Investigator**

- Sponsors: Medevac Foundation & CTSC (PI: Andrew Reimer)
- Title: Assessment of Patient’s Exposure to Transport

This study is to evaluate patient’s exposure to ground and air transport by employing a multi-sensor device.

OTHER ACADEMIC AND SERVICE ACTIVITIES

Service **Case Western Reserve University:**

Interim Research Committee, Case School of Engineering (Fall 2008)

Undergraduate Committee, Department of Mechanical and Aerospace Engineering (Fall 2008)

Graduate Admission Committee, Department of Mechanical and Aerospace Engineering (Spring 2009)

Judge, Research ShowCASE (April 2009)

Faculty Host, WISER “Introduce a Girl to Engineering Day” (February 2010 ~ 2012)

Judge, Research ShowCASE (April 2010)

Graduate Committee, Case School of Engineering (Fall 2010 – Present)

Advising

Graduate Advisees: Donghwa Jeong (Ph.D. Expected 2014), Christian Puehn (MS Expected 2014), Shuo Li (MS Expected 2014), Tao Liu (MS Expected 2014), Kai Zhang (MS Expected 2014), Ken Hornfeck (MS May 2011), Yan Zhang (MS May 2011), Beatrice Floyd (MS May 2012)

Undergraduate Research Advisees: Alexander Caveny (BS/MS Expected 2015), Yixin Feng (BS Expected 2015), Evan Vanderhoff (BSE Expected 2014), Isaac Shyu (BS Expected 2016), Jeremy Couch (BSE 2011), Endri Kerici (BSE 2011),

Others: Bolutife Ogunjobi (Visiting Student, May-July 2010, ACES+ Summer Research Student)

Committee Ph.D. Dissertation Committee: Richard Bachman (Ph.D. 2009, Advisor: Roger Quinn), Brandon Rutter (Ph.D. 2009, Advisor: Roger Quinn), Jeremy Marvel (Ph.D. 2010, Advisor: Wyatt Newmann), Kathryn Daltorio (Ph.D. 2013, Advisor: Roger Quinn)

MS Thesis Committee: Alexander Boxerbaum (MS 2010, Advisor: Roger Quinn), Taoming Liu (MS 2010, Research Advisor: Cenk Cavusoglu, Academic Advisor: Kiju Lee), Nicole Doorly (MS 2010, Advisor: Roger Quinn)

Qualifying Exam Committee: Alexander Hunt (Jan. 2013), Craig J. Slyfield (Jan. 2009) and Zamir Zulkefli (Sep. 2009)

Memberships IEEE (Institute of Electrical and Electronics Engineers), 2005 – present
AIAA (American Institution in Aeronautics and Aerospace), 2007 – present
ASME (American Society of Mechanical Engineers), 2012 – present
SWE (Society of Women Engineers), 2007 – 2010

Reviewer **Journal/Conference Article Review:** International Journal of Robotics Research, IEEE Robotics and Automation Magazine, Robotica, Mechanism and Machine Theory, IEEE International Conference on Intelligent Robots and Systems (IROS), IEEE International Conference on Robotics and Automation (ICRA), Journal of Circuits, Systems and Computers, Mechanism and Machine Theory, IEEE/ASME International Conference on Advanced Intelligent Mechatronics, Book Chapter Review

Grant Review: NSF (Review Panel, Programs: CRI, RI)

Others Session Co-chair, International Conference on Advanced Robotics, Jeju, Korea, 2007
Session Chair, International Symposium on Computational Intelligence in Robotics and Automation, Daejeon Korea, 2009
International Program Committee, International Conference on Intelligence Robotics and Applications, Shanghai, China, 2010
Program Committee, International Conference on Intelligence Robotics and Applications, Aachen, Germany, 2011
Guest Co-Editor, Special Issue on User Assessment in Serious Games and Technology-Enhanced Learning, Advance in Human-Computer Interaction Journal, Hindawi, 2012
Associate Editor, International Conference on Robotics and Automation, 2013

FELLOWSHIPS AND AWARDS

Sep 1999 University Scholarship, Chung-Ang University, Seoul, Korea
2003-2005 Graduate Research Fellowship, Korea Science and Engineering Foundation (KOSEF)
Dec 2004 Critic's Choice Award (1st place), Art Robot Competition, Johns Hopkins University
Apr 2007 Creel Family Teaching Assistant Award, Mechanical Engineering, Johns Hopkins University

PATENTS

Inventor of SIG-Blocks and TAG-Games, Invention Disclosure filed in April 2010, Provisional Patent filed in April 2011, and US Patent filed in April 2012.

Co-Designer of an Exercise Jogging Stroller, sponsored by BB Baby, LLC, US Patent Pending