

**PERSONAL
INFORMATION**

Affiliation : Postdoctoral Research Fellow
 Medical Assistant Robotics and Cognitive Haptics Lab.,
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 National Agenda Research Division,
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**RESEARCH
INTERESTS****Dynamic Modeling and System Integration for Robotic and Mechatronic Applications**

- **Dynamics:** ★ Newtonian Mechanics, ★ Lagrangian Mechanics, ★ Contact Mechanics
- **Mechatronics:** ★ Precision Mechanism ★ Redundant Mechanism ★ Machine Vision
- **Robotics:** ★ Robot Kinematics and Dynamics ★ Motion Control
- **Applications:** ★ Redundant Parallel Align Stage ★ Micromanipulator ★ Stereotactic Surgical Robot ★ Haptic Display System

EDUCATION

PH.D.

Sungkyunkwan University, Suwon, Korea

February 2013

Adviser: Prof. Ja Choon Koo

- Mechanical Engineering (Applied Mechanic and System Engineering)
- Dissertation: "Design and Analysis of Redundant Parallel Micro Manipulator for Maskless Lithography System"

M.SC.

Sungkyunkwan University, Suwon, Korea

February 2008

Adviser: Prof. Ja Choon Koo

- Mechanical Engineering
- Dissertation: "Design and Development of a Vision System for Micromanipulations"

B.SC.

Sungkyunkwan University, Suwon, Korea

February 2006

Adviser: Prof. Hyouk Ryeol Choi

- Mechanical Engineering
- Dissertation: "Four-Legged Walking Robot DDasiki"

EMPLOYMENT

MAY 2014

~ PRESENT

Postdoctoral Research Fellow
 Interaction and Robotics Research Center, National Agenda Research Division,
 Korea Institute of Science and Technology (KIST), Seoul, Korea

MARCH 2013 ~ APRIL 2014 **Senior Research Engineer**
Advanced Patterning Team, Process Technology Department,
LG Production Engineering Research Institute, LG Electronics, Pyeongtaek, Korea

MARCH 2006 ~ FEBRUARY 2013 **Graduate Research Assistant and Teaching Assistant**
Department of Mechanical Engineering, College of Engineering, Sungkyunkwan University,
Suwon, Korea

RESEARCH EXPERIENCE

Postdoctoral Research Fellow (Director: Dr. Keehoon Kim), Medical Assistant Robotics and Cognitive Haptics Lab., Korea Institute of Science and Technology (KIST), Seoul, Korea

2014 ~ PRESENT **Integrated Kinesthetic and Cutaneous (Tactile) Haptic Display System** sponsored by *Ministry of Science, ICT and Future Planning*

- Analyzing squeeze film effect for an adjustable surface friction factor.
- Analyzing z-directional drop motion for a slip/shear display and developing its mechanism.
- Designing seven-DOFs manipulator for a haptic display system.

2014 ~ PRESENT **Stereotactic Surgical Robot Interface** sponsored by *Korea Institute of Science and Technology*

- Evaluating stereotactic surgical robot by using small animal testing.
- Enhancing servo performance of a high precision positioning system.

Senior Research Engineer (Vice President: Soo Hoa Jeong), Advanced Patterning Team, LG Production Engineering Research Institute, LG Electronics, Pyeongtaek, Korea

2013 ~ 2014 **Ultra Precision Opto-Mechanical Systems for High-Resolution UV Lithography Equipment** sponsored by *LG Production Engineering Research Institute*

- Designed and developed an opto-mechanical system for projection lithography equipment.
- Analyzed and estimated a scanning stage of 8G proximity lithography equipment by using finite element method.

Graduate Research Assistant (Adviser: Prof. Ja Choon Koo), Computer Aided Machine Dynamic System Lab., Sungkyunkwan University, Suwon, Korea

2010 ~ 2012 **Precise Position Align System Based on Redundant Parallel Mechanism** sponsored by *Ministry of Knowledge Economy (Republic of Korea)*

- Proposed kinematic configuration of six-DOFs redundant parallel mechanism based on 4P[PP]S.
- Conducted theoretical analysis of kinematics(inverse, forward) and Jacobian matrix.
- Defined and conducted motion primitive about mobile platform and verified the motion by using multi-body dynamic simulation.
- Implemented and evaluated a position accuracy by using capacitance probe.

2009 ~ 2011 **Precise Two-DOFs Decoupled Kinematic Mechanism with High Rigidity** sponsored by *Ministry of Knowledge Economy (Republic of Korea)*

- Designed a decoupled kinematic mechanism by using four units.
- Proposed two kinds of configurations: simultaneous and selective mechanism.

- Implemented and evaluated a selective actuator module for six-DOFs parallel mechanism.
- Measured a position accuracy by using laser doppler vibrometer and capacitance probe.

2008 ~ 2010

Micro Force Sensor by using Multi Strain Gauges sponsored by *Ministry of Commerce, Industry and Energy (Republic of Korea)*

- Designed a structure of low cost force sensor based on notched cantilever and strain gages.
- Verified the structure using finite element analysis.
- Enhanced measuring accuracy using sensor fusion algorithm(Kalman filtering) in the same domain.
- Conducted hardware setup and measuring accuracy test using contact detection in the micro/nano manipulation system.

2008 ~ 2009

Dynamic Modeling of Micro/Nano Scale Phenomena sponsored by *Ministry of Commerce, Industry and Energy (Republic of Korea)*

- Developed the dynamic model of adhesion force and micro contact mechanics by using the micro/nano dynamics.
- Implemented non-stick end-effector for the grasplless and pushing manipulation.
- Verified the hardware and dynamic model by manipulating micro scaled single particle and multi particles.
- Developed dynamic model of rolling and sliding manipulation by using micro contact mechanics.

2007 ~ 2009

Fully Autonomous Micro Manipulation System with Visual Feedback sponsored by *Ministry of Commerce, Industry and Energy (Republic of Korea)*

- Designed multi-DOF manipulator based on serial mechanism and AFM probe as an end-effector.
- Implemented microscope vision system as a visual feedback system.
- Designed a planning algorithm for autonomous manipulation and implementation of controller.
- Demonstrated grasplless and pushing manipulation by using $30\mu\text{m}$ micro scaled particles.

2006 ~ 2007

Visual Tracking Algorithm for Micro Scaled Particles and AFM Probe sponsored by *Ministry of Commerce, Industry and Energy (Republic of Korea)*

- Designed salt and pepper noise filtering algorithm by using region median filter and thresholding.
- Identified algorithm for determinate forms such as circle, square and triangle.
- Identified algorithm for indeterminate form like rod.
- Implemented pseudo real-time position tracking system based on Visual C++(MFC)by using multi thread function.

2006 ~ 2007

Non-Contact Measurement System for Dynamic Characteristic of Fluid Dynamic Bearing sponsored by *Samsung Electronics Co., Ltd.*

- Developed a fluid film of fluid dynamic bearing with structure mesh.
- Simulated stiffness and damping coefficients using computational fluid dynamics.
- Implemented hardware of non-contact measurement system using air pressure force and capacitive probe.
- Measured stiffness coefficient using non-contact measurement system.

HONORS AND AWARDS

- JANUARY 2013 **Industrial Fellowship**, LG Electronics, Seoul, Korea
- MARCH 2009 **Seoul Science Fellowship**, Seoul Scholarship Foundation, Seoul, Korea
- JUNE 2008 **The Best Paper Award**, “Design of Non-stick Micromanipulation for Handling of Micro particle,” *Korea Robotics Society 2008 Annual Conference*
- JUNE 2007 **The Best Paper Award**, “Improvement of Micro Force Sensing in Micro Manipulation System,” *Korean Society for Precision Engineering 2007 Annual Spring Conference*
- MAY 2007 **The Best Paper Award**, “Correction of Mass Inbalance of a High Precision Rotor,” *Korean Society of Noise and Vibration Engineering 2007 Annual Spring Conference*

SKILLS AND ABILITIES

1. Programming Software and Tools

- C/C++ • Python • Microsoft Visual Studio
- RTX RTOS Platform • Mil Library • OpenCV
- Matlab • Simulink • Labview
- Autodesk Inventor • Solidworks • Pro-Engineer • Creo • AutoCad
- Ansys Classic/Workbench • RecurDyn • CFD-RC

2. Hardware and Equipments

- Stage(Physik Instrumente, Klocke) • Actuator(Maxon, Faulhaber)
- Amplifier/Controller(Maxon, Elmo)
- DAQ Board(National Instruments, Advantech) • PXI(National Instruments)
- Frame Grabber(Matrox Helios XCL) • Digitizer(SVS285) • Microscope(BX51)
- Capacitive Probe(ADE) • Laser Doppler Vibrometer(Polytec) • Laser(Keyence)
- Dynamic Signal Analyzer(Agilent) • Charge Conditioning Amplifier(Nexus) • Strain Amplifier(Kyowa)
- Microcontroller(Microchip PIC)

PUBLICATIONS

DISSERTATION

1. **Yong Seok Ihn**, “Design and Analysis of Redundant Parallel Micro Manipulator for Maskless Lithography System,” Ph.D. Dissertation, Sungkyunkwan University, Feb. 2008.
2. **Yong Seok Ihn**, “Design and Development of a Vision System for Micromanipulations,” M.Sc. Dissertation, Sungkyunkwan University, Feb. 2008.

INVITED WORKSHOP

3. **Yong Seok Ihn**, Yoo Chang Kim, and Ja Choon Koo, “Precision manipulation using multi-DOFs motion stage,” *Workshop on Merging micro & macro manipulation and manufacturing technologies and methods part of the IEEE/ASME Int. Conf. on Advanced Intelligent Mechatronics (AIM 2014)*, Jul. 2014.

4. **Yong Seok Ihn**, Sang-Hoon Ji, Hyungpil Moon, Hyouk Ryeol Choi, and Ja Choon Koo, "Kinematic design of a redundant parallel mechanism for maskless lithography optical instrument manipulations," *Microsyst. Technol. (SCI)*, vol. 20, no. 8–9, pp. 1479–1490, May 2014. Available: doi:[10.1007/s00542-014-2145-4](https://doi.org/10.1007/s00542-014-2145-4).
5. **Yong Seok Ihn**, Sang-Hoon Ji, Hyungpil Moon, Hyouk Ryeol Choi, and Ja Choon Koo, "A Dual Step Precision Multi-DOF Stage for Maskless Digital Lithography," *Microsyst. Technol. (SCI)*, vol. 18, no. 9–10, pp. 1741–1750, Sept. 2012. Available: doi:[10.1007/s00542-012-1619-5](https://doi.org/10.1007/s00542-012-1619-5).
6. Yoo Chang Kim, **Yong Seok Ihn**, Hyungpil Moon, Kyung Tae Nam, Sang Moo Lee, Hyouk Ryeol Choi, and Ja Choon Koo, "Low Cost Dual Axis Micro Force Sensor for Robotic Manipulations," *Microsyst. Technol. (SCI)*, vol. 17, no. 5–7, pp. 1197–1205, Jan. 2011. Available: doi:[10.1007/s00542-011-1269-z](https://doi.org/10.1007/s00542-011-1269-z).
7. Tri Cong Phung, **Yong Seok Ihn**, Ja Choon Koo, and Hyouk Ryeol Choi, "An Enhanced Edge Tracking Method Using a Low Resolution Tactile Sensor," *Int. J. Control Autom. Syst. (SCIE)*, vol. 8, no. 2, pp. 462–467, Apr. 2010. Available: doi:[10.1007/s12555-010-0235-3](https://doi.org/10.1007/s12555-010-0235-3).
8. Tri Cong Phung, **Yong Seok Ihn**, Ja Choon Koo, and Hyouk Ryeol Choi, "Edge Identification of a Small Object through a Low-Resolution Tactile Sensor Array," *Int. J. Precis. Eng. Manuf. (SCIE)*, vol. 11, no. 2, pp. 247–254, Apr. 2010. Available: doi:[10.1007/s12541-010-0028-x](https://doi.org/10.1007/s12541-010-0028-x).
9. **Y. S. Ihn**, S. K. Kim, Dongho Oh, M. E. Kim, and Ja Choon Koo, "Non-contact measurement method of mechanical stiffness for high revolutionary speed precision fluid dynamic bearing rotors," *Microsyst. Technol. (SCI)*, vol. 16, no. 1–2, pp. 233–240, Jan. 2010. Available: doi:[10.1007/s00542-009-0849-7](https://doi.org/10.1007/s00542-009-0849-7).
10. **Y. S. Ihn**, J. K. Lee, D. H. Oh, H. S. Lee, and J. C. Koo, "Active Correction of Dynamic Mass Imbalance for a Precise Rotor," *IEEE Trans. Magn. (SCI)*, vol. 45, no. 11, pp. 5088–5093, Nov. 2009. Available: doi:[10.1109/TMAG.2009.2029622](https://doi.org/10.1109/TMAG.2009.2029622).
11. **Y. S. Ihn**, Y. C. Kim, H. R. Choi, S. M. Lee, and J. C. Koo, "Design of Non-stick Micromanipulation for Handling of Micro particle," *J. of Korea Robotics Society*, vol. 4, no. 3, pp. 225–232, Sept. 2009.
12. Tri Cong Phung, Seung Hwa Ha, **Yong Seok Ihn**, Byung June Choi, Sang Moo Lee, Ja Choon Koo, and Hyouk Ryeol Choi, "An Enhanced Force and Contact Position Sensor for Micro-Manipulations," *Int. J. Control Autom. Syst. (SCIE)*, vol. 7, no. 3, pp. 459–467, Jan. 2009. Available: doi:[10.1007/s12555-009-0315-4](https://doi.org/10.1007/s12555-009-0315-4).
13. S. B. Lee, **Y. S. Ihn**, D. H. Oh, H. Y. Kim, H. S. Lee, and J. C. Koo, "Correction of Mass Unbalance of a High Precision Rotor," *Trans. Korean Soc. Noise Vib. Eng.*, vol. 17, no. 8, pp. 720–725, Aug. 2007. Available: doi:[10.5050/KSNVN.2007.17.8.720](https://doi.org/10.5050/KSNVN.2007.17.8.720).
14. Seung Hwa Ha, Byung June Choi **Yong Suk Ihn**, Tri Cong Phung, Sang Moo Lee, J. C. Koo, and H. R. Choi "Micro-Force Sensing for a Micro Manipulation System," *J. Korean Soc. Precis. Eng.*, vol. 24, no. 7, pp. 13–18, Jul. 2007.
15. Nam-Hoon Lee, Sang-Heon Lyu, **Yong-Seok Ihn**, J. C. Koo, Yeon-Sun Choi, "Simulation for Defect Diagnosis in Belt Transport System," *Trans. Korean Soc. Noise Vib. Eng.*, vol. 16, no. 4, pp. 366–371, Apr. 2006. Available: doi:[10.5050/KSNVN.2006.16.4.366](https://doi.org/10.5050/KSNVN.2006.16.4.366).

16. Jong Yoon Choi, Sae Whan Park, **Yong Seok Ihn**, Zheng Yuan Li and Ja Choon Koo, "Optical Head Alignment Method Using Serial Manipulators for Maskless Lithography System," in *Proc. of the ASME 2014 Conf. on Information Storage and Processing Systems (ISPS 2014)*, pp. V001T07A004, June 2014. Available: doi:[10.1115/ISPS2014-6927](https://doi.org/10.1115/ISPS2014-6927).
17. Zheng Yuan Li, Sae Whan Park, **Yong Seok Ihn**, Jong Yoon Choi and Ja Choon Koo, "Parallel Micro Manipulator for Effective Optical Spot Array Alignment," in *Proc. of the ASME 2014 Conf. on Information Storage and Processing Systems (ISPS 2014)*, pp. V001T07A005, June 2014. Available: doi:[10.1115/ISPS2014-6929](https://doi.org/10.1115/ISPS2014-6929).
18. **Yong Seok Ihn**, Sae Whan Park, and, Ja Choon Koo, "Position Alignment of Micro Manipulator using Root Mean Square Errors for Maskless Lithography System," in *Proc. of the ASME 2013 Conf. on Information Storage and Processing Systems (ISPS 2013)*, pp. V001T07A013, June 2013. Available: doi:[10.1115/ISPS2013-2943](https://doi.org/10.1115/ISPS2013-2943)
19. **Yong Seok Ihn**, Hyungpil Moon, Hyouk Ryeol Choi, and Ja Choon Koo, "Design and Implementation of a 2-DOF Decoupled Kinematic Actuator Module," in *Proc. of the 2012 IEEE/RSJ Int. Conf. on Intelligent Robots and Systems (IROS 2012)*, pp. 2533–2538, Oct. 2012. Available: doi:[10.1109/IROS.2012.6386245](https://doi.org/10.1109/IROS.2012.6386245). [**Oral Presentation**]
20. **Y. S. Ihn**, Seung Guk Baek, Ho Gyun Won, Sang-Hyun Park, and J.C. Koo, "Kinematic Formulation and Analysis about a Dual Step Precision Multi-DOF Stage," in *Proc. of the 6th Asian Conf. on Multibody Dynamics (ACMD 2012)*, Aug. 2012. [**Oral Presentation**]
21. **Y. S. Ihn**, Seung Guk Baek, M. H. Yang, Ho Gyun Won, and J. C. Koo, "A Kinematic Analysis of Parallel Manipulator for a Dexterous Motion Control with Path Planning," in *Proc. of the 2012 ASME-ISPS/JSME-IIP Joint Int. Conf. on Micromechanics for Information and Precision Equipment (MIPE 2012)*, pp. 346–348, June 2012. [**Oral Presentation**]
22. **Y. S. Ihn**, M. H. Yang, Sangjoon Hong, Sang-Hyun Park, Oui Serg Kim, Sangdon Jang, and, J. C. Koo, "Implementation and Mechanism Analysis via a Geometric Approach about Parallel Manipulator," in *Proc. of the ASME 2011 Conf. on Information Storage and Processing Systems (ISPS 2011)*, pp. 124–126, June 2011. [**Oral Presentation**]
23. Y. C. Kim, **Y. S. Ihn**, H. R. Choi, H. P. Moon, Sangjoon Hong, Sang-Hyun Park, Oui Serg Kim, Sangdon Jang, J. C. Koo, "Mechanism Analysis and Simulation Platform for a Novel Parallel Manipulator of Six Degree of Freedoms," in *Proc. of the 7th Int. Conf. on Ubiquitous Robots and Ambient Intelligence (URAI 2010)*, pp. 596–597, Nov. 2010.
24. **Y. S. Ihn**, J. C. Koo, D. H. Oh, C. S. Kim and H. Y. Kim, "Mechanical Damping Measurement of Small Size Hydrodynamic Bearing Rotors without Physical Contact," in *Proc. of the 8th IFToMM Int. Conf. Rotor Dynamics*, pp. 1045-1048, Sept. 2010. [**Oral Presentation**]
25. Y. C. Kim, **Y. S. Ihn**, H. R. Choi, S. M. Lee, and J. C. Koo, "Implementation of Force Sensor with Multi Strain Gauges for Enhancing Accuracy and Precision," in *Proc. of the 2010 IEEE/ASME Int. Conf. on Mechatronic and Embedded Systems and Applications (MESA 2010)*, pp. 192–195, Jul. 2010. Available: doi:[10.1109/MESA.2010.5552076](https://doi.org/10.1109/MESA.2010.5552076).

26. Y. C. Kim, **Y. S. Ihn**, H. R. Choi, H. P. Moon, K. T. Nam, S. M. Lee, J. C. Koo, "Dual Axis Force Sensing Device for Microscale Robotic Manipulations," in *Proc. of the ASME 2010 Conf. on Information Storage and Processing Systems (ISPS 2010)*, pp. 159–161, June 2010.
27. **Y. S. Ihn**, Dongho Oh, Ho Seong Lee, J. C. Koo, "A Hybrid Observer Design for Periodic Disturbance Compensation," in *Proc. of the ASME 2010 Conf. on Information Storage and Processing Systems (ISPS 2010)*, pp. 85–87, June 2010. **[Oral Presentation]**
28. **Y. S. Ihn**, Y. C. Kim, H. R. Choi, S. M. Lee, and J. C. Koo, "Implementation of Grasplless Handling System for Microparticles using AFM Probe," in *Proc. of the 2009 IEEE/RSJ Int. Conf. on Intelligent Robots and Systems(IROS 2009)*, pp. 1843–1848, Oct. 2009. Available: doi:[10.1109/IROS.2009.5354170](https://doi.org/10.1109/IROS.2009.5354170). **[Oral Presentation]**
29. Y. C. Kim, **Y. S. Ihn**, S. M. Lee, H. R. Choi, J. C. Koo, "Design of Micro Force Sensor using Strain Gauges," in *Proc. of the 6th Int. Conf. on Ubiquitous Robots and Ambient Intelligence (URAI 2009)*, pp. 636–638, Oct. 2009.
30. **Y. S. Ihn**, Y. C. Kim, S. M. Lee, H. R. Choi, J. C. Koo, "A Study of Rolling and Sliding Condition for Micromanipulation System," in *Proc. of the 6th Int. Conf. on Ubiquitous Robots and Ambient Intelligence (URAI 2009)*, pp. 800–802, Oct. 2009.
31. J. K. Lee, **Y. S. Ihn**, J. C. Koo, Dongho Oh, Ho Sung Lee, "Active Correction of Mass Imbalance for a Precise Rotor," in *Proc. of the Asia-Pacific Magnetic Recording Conf. (APMRC 2009)*, pp. AB–2, Jan. 2009. Available: doi:[10.1109/APMRC.2009.4925392](https://doi.org/10.1109/APMRC.2009.4925392).
32. **Y. S. Ihn**, S. K. Kim, J. K. Lee, M. E. Kim, Dongho Oh, J. C. Koo, "A Novel Identification of Mechanical Damping Coefficients of High Speed Fluid Dynamic Bearing for HDDs without Physical Contact," in *Proc. of the Asia-Pacific Data Storage Conf. (APDSC 2008)*, pp. 102–103, Dec. 2008. **[Oral Presentation]**
33. **Y. S. Ihn**, S. K. Kim, M. E. Kim, Dongho Oh, J. C. Koo, "A Non-Contact Mechanical Characteristics Measurement Method for High Revolutionary Speed Precision Fluid Dynamic Bearing Rotors," in *Proc. of the ASME 2008 Conf. on Information Storage and Processing Systems (ISPS 2008)*, pp. SMA–B4, June 2008. **[Oral Presentation]**
34. **Y. S. Ihn**, S. H. Ha, H. R. Choi, J. C. Koo and S. M. Lee, "The Binary Recognition Algorithm Using Point Correlation Template," in *Proc. of the 4th Int. Conf. on Ubiquitous Robots and Ambient Intelligence (URAI 2007)*, pp. 564–569, Nov. 2007.
35. **Y. S. Ihn**, H. S. Ha, B. J. Choi, H. R. Choi, S. M. Lee and J. C. Koo, "Design of a Modified Binary Region Median Filtering for Micro Electronic Device Assembly Manipulations," in *Proc. of the Int. Conf. on Control Automation and Systems (ICCAS 2007)*, pp. 2749–2753, Oct. 2007. Available: doi:[10.1109/ICCAS.2007.4406835](https://doi.org/10.1109/ICCAS.2007.4406835). **[Oral Presentation]**
36. **Y. S. Ihn**, S. H. Ryu, B. J. Choi, S. H. Ha, H. R. Choi, S. M. Lee and J. C. Koo, "An Enhanced Vision Processing Algorithm for a Micro-manipulation System," in *Proc. of the Int. Workshop on Robotic and Sensors Environments (ROSE 2007)*, pp. 7–12, Oct. 2007. Available: doi:[10.1109/ROSE.2007.4373959](https://doi.org/10.1109/ROSE.2007.4373959). **[Oral Presentation]**
37. Tri Cong Phung, Byung June Choi, Sang Heon Ryu, Seung Hwa Ha, **Yong Seok Ihn**, Sangdeok Park, Sangmoo Lee, Ja Choon Koo and Hyouk Ryeol Choi, "Contact Position and Force Sensing in Micro-manipulation," in *Proc. of the 13th Int. Conf. on Advanced Robotics (ICAR 2007)*, pp. 272–277, Aug. 2007.

PATENTS

1. Sang Joon Hong, Sang Hyun Park, Sang Don Jang, Oui Serg Kim, Ja Choon Koo, **Yong Seok Ihn**, Jung Woong Jang, Yoo Chang Kim, “Actuator, stage device, and exposure apparatus”
 - **U.S. Patent No. US8,593,616** issued on November 26th, 2013 (Appl. Serial No. US12/926,473 filed on November 11th, 2010)
 - Korea Patent Appl. No. 10-2009-0120694 filed December 7th, 2009
2. Ja Choon Koo, **Yong Seok Ihn**, Jung Kwan Lee, Sung Moo Ryu, Sang Moo Lee, Byung Rok So, “Apparatus for safe joint for robot”
 - **Korea Patent No. 10-1159421** issued June 18th, 2012 (Appl. Serial No. 10-2009-0128893 filed December 22th, 2009)
3. Hyouk Ryeol Choi, Ja Choon Koo, Byung June Choi, Seung Hwa Ha, **Yong Seok Ihn**, Mu Sang Lee, “Micro force sensor”
 - **Korea Patent No. 10-0965386** issued January 14th, 2010 (Appl. Serial No. 10-2007-0097214 filed September 27th, 2007)
4. Hyouk Ryeol Choi, Ja Choon Koo, Byung June Choi, Sang Heon Ryu, Seung Hwa Ha, **Yong Seok Ihn**, Son Woong Hee, Mu Sang Lee, Sangdeok Park, Kyung Tae Nam, “Probe and method measuring contact force and contact location in three dimension using thereof”
 - **Korea Patent No. 10-0793184** issued January 3th, 2008 (Appl. Serial No. 10-2006-0133295 filed on December 24th, 2006)

REFERENCES

References are available upon request