

# NAMWOO KANG (강남우)

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## RESEARCH INTERESTS

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- **AI-based Design** / Generative Design / Data-driven Design / Deep Learning/ Machine Learning
- **Design Optimization**/ Multidisciplinary Design Optimization/ Simulation-based Optimization
- **Design for Market Systems**/ Consumer Preference Models/ Big Data Analysis
- **Smart Mobility**/ Shared Autonomous Electric Vehicle/ Personal Mobility
- **Human-Computer Interaction**/ User Experience

## EDUCATION

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<b>University of Michigan</b>	Ann Arbor, MI
<b>Ph.D. Design Science</b> (Mechanical Engineering + Marketing)	2011 – 2014
Co-advisors: Prof. Panos Papalambros, Prof. Fred Feinberg	
<b>Seoul National University</b>	Seoul, Korea
<b>M.S. Technology and Management</b>	2005 – 2007
<b>B.S. Mechanical and Aerospace Engineering</b>	2000 – 2005

## ACADEMIC APPOINTMENTS

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<b>Sookmyung Women's University</b>	Seoul, Korea
<b>Assistant Professor</b> , Mechanical Systems Engineering	2018 – Present
<b>KAIST</b>	Daejeon, Korea
<b>Assistant Professor</b> , K-School	2016 – 2018
<b>University of Michigan</b>	Ann Arbor, MI, USA
<b>Research Fellow and Adjunct Lecturer</b> , Mechanical Engineering	2014 – 2016

## INDUSTRIAL EXPERIENCE

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<b>Hyundai Motor Company</b>	Jeonbuk, Korea
<b>Research Engineer</b> , R&D Center	2007 – 2010

## AWARDS

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• Young Scientist Award, ACSMO (Asian Congress of Structural and Multidisciplinary Optimization)	2020
• 미래기술상, 한국전산구조공학회	2019
• Dow Distinguished Award, Dow Sustainability Fellows, University of Michigan	2014

## PROFESSIONAL SERVICE

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- 부단장 - LINC+ 4차산업혁명 혁신선도대학 (숙명여대)
- Associate Editor - Journal of Mechanical Science and Technology (JMST) -
- CAE 및 응용역학부문 총무이사 - Korean Society of Mechanical Engineers (KSME)
- 인공지능머신연구회 이사 - Korean Society of Mechanical Engineers (KSME)
- 인공지능소사이어티 이사 - Korean Institute of Information Scientists and Engineers (KIISE)
- 논문집편집위원회 편집위원 - Computational Structural Engineering Institute of Korea (COSEIK)

## MEMBERSHIPS

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- Korean Society of Mechanical Engineers (KSME)
- Korean Institute of Information Scientists and Engineers (KIISE)
- Computational Structural Engineering Institute of Korea (COSEIK)
- Korean Society for Design Optimization (KSDO)
- Korean Society for Prognostics and Health Management (KSPHM)
- American Society of Mechanical Engineers (ASME)
- Asian Society for Structural and Multidisciplinary Optimization (ASSMO)
- International Society for Structural and Multidisciplinary Optimization (ISSMO)
- Design Society

## TEACHING EXPERIENCES

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### Sookmyung Women's University

2018 - Present

- Solid Mechanics (Undergraduate course)
- Machine Learning and Practice (Undergraduate course)
- Engineering Design and Practice (Undergraduate course)
- Capstone Design (Undergraduate course)
- Automotive Engineering (Undergraduate course)
- Engineering Mathematics (Undergraduate course)
- Programming Basics and Practice (Undergraduate course)
  
- Artificial Intelligence and Mechanical Engineering (Graduate course)
- Deep Learning and Engineering Design (Graduate course)
- Intelligent Design Automation (Graduate course)
- Design Optimization (Graduate course)
- Multidisciplinary Design Optimization (Graduate course)
- Advanced Intelligent Vehicles (Graduate course)
- Interdisciplinary Vehicle Design (Graduate course)
- Mechanical Engineering Seminar: Advanced Deep Learning (Graduate course)

### KAIST

2016 - 2018

- Advanced Multidisciplinary Capstone Design (Graduate course)
- Multidisciplinary Capstone Design I (Undergraduate course)
- Multidisciplinary Capstone Design II (Undergraduate course)
- Design Thinking for Startup (Undergraduate and graduate course)
- Startup Management Practice (Graduate course)
- Entrepreneurship (Graduate course)
- Capstone Design I (Undergraduate course) - Guest
- Capstone Design II (Undergraduate course) - Guest

### University of Michigan

2012 - 2016

- Design Optimization (Graduate course)
- Analytical Product Design (Graduate course) - Guest
- Product Design Process (Graduate course) - Guest
- Design and Manufacturing (Undergraduate course) - Guest

\*corresponding author

### Journal Papers under Review (International)

- [9] Yoo, S. and **Kang, N.\*** “Explainable Artificial Intelligence for Manufacturing Cost Estimation and Machining Feature Visualization”, *Expert Systems with Applications*, arXiv:2010.14824.
- [8] Kim, S., Lee, U., Lee, I. and **Kang, N.\*** “Idle Vehicle Relocation Strategy through Deep Learning for Shared Autonomous Electric Vehicle System Optimization”, *Applied Energy*, arXiv:2010.09847.
- [7] Jang, S. and **Kang, N.\*** “Generative Design by Reinforcement Learning: Maximizing Diversity of Topology Optimized Designs”, *Computer-Aided Design*, arXiv:2008.07119.
- [6] Yoo, S., Lee, S., Kim, S., Hwang, K. H., Park, J. H., **Kang, N.\*** “Integrating Deep Learning into CAD/CAE System: Case Study on Road Wheel Design Automation”, *Structural and Multidisciplinary Optimization*, arXiv:2006.02138.
- [5] **Kang, N.**, Ren, Y., Feinberg, F. M., and Papalambros, P. Y. “Form + Function: Optimizing Aesthetic Product Design via Adaptive, Geometrized Preference Elicitation”, *Marketing Science*, arXiv:1912.05047.
- [4] Yoo, S., Lee, S., Kim, S., Kim, E., Hwangbo, H., and **Kang, N.\*** “A Study on Anxiety about Using Robo-taxis: HMI Design for Anxiety Factor Analysis and Anxiety Relief Based on Field Tests”, *Human-Computer Interaction*, arXiv:2002.09155.
- [3] Lee, S., Yoo, S., Kim, S., Kim, E., and **Kang, N.\*** “An Effect of Robo-taxi User Experience on User Acceptance: Field Test Data Analysis”, *Transportation Research Record: Journal of the Transportation Research Board*, arXiv:2006.16870.
- [2] Lee, K. J., **Kang, N.\***, Kokkolaras, M., and Papalambros, P. Y. “Design Optimization of a Hybrid Electric Vehicle Cooling System Considering Performance and Packaging”, *International Journal of Vehicle Design*
- [1] Lee, G., Rhim, J., **Kang, N.**, and Lee, J. “Moral Reasonings in Autonomous Vehicles Moral Dilemma Situations from Human Driver’s Perspective: Values and Themes”, *Science and Engineering Ethics*

### Journal Papers (International)

- [19] Lee, U., **Kang, N.\***, and Lee, I. (2020) “Choice Data Generation using Usage Scenarios and Discounted Cash Flow Analysis”, *Journal of Choice Modelling*, 37, 100250.
- [18] Jung, Y., Lee, J., Lee, M., **Kang, N.\***, and Lee, I. (2020) “Probabilistic Analytical Target Cascading using Kernel Density Estimation for Accurate Uncertainty Propagation”, *Structural and Multidisciplinary Optimization*, Vol. 61, No. 5, pp. 2077–2095.
- [17] Kim, S., Chang, J., Park, H. H., Song, S. U., Cha, C. B., Kim, J. W., **Kang, N.\*** (2020) “Autonomous Taxi Service Design and User Experience”, *International Journal of Human-Computer Interaction*, Vol. 36, No. 5, pp. 429–448.
- [16] Lee, U., **Kang, N.\***, and Lee, I. (2020) “Shared Autonomous Electric Vehicle Design and Operations Under Uncertainties: A Reliability-based Design Optimization Approach”, *Structural and Multidisciplinary Optimization*, Vol. 61, pp. 1529–1545.
- [15] Oh, S., Jung, Y., Kim, S., Lee, I., and **Kang, N.\*** (2019) “Deep Generative Design: Integration of Topology Optimization and Generative Models”, *Journal of Mechanical Design*, Vol. 141, No. 11, 111405.
- [14] **Kang, N.**, Feinberg, F. M., and Papalambros, P. Y. (2019) “Designing Profitable Joint Product–Service Channels: Case Study on Tablet and eBook Markets”, *Design Science*, Vol. 5, e12.
- [13] Koh, S. R., Hur, S. H., and **Kang, N.\*** (2019) “Feasibility Study on the Korean Government’s Hybrid Conversion Project of Small Diesel Trucks for Parcel Delivery Services”, *Journal of Cleaner Production*, Vol. 232, pp.559–574.
- [12] Lee, U., **Kang, N.\***, and Lee, I. (2019) “Selection of Optimal Target Reliability in RBDO through Reliability-based Design for Market Systems (RBDMS) and Application to Electric Vehicle Design”, *Structural and Multidisciplinary Optimization*, Vol. 60, No. 3, pp.949–963.
- [11] **Kang, N.**, Bayrak, A., and Papalambros, P. Y. (2018) “Robustness and Real Options for Vehicle Design and Investment Decisions under Gas Price and Regulatory Uncertainties”, *Journal of Mechanical Design*, Vol. 140, No. 10, 101404.
- [10] Jung, Y., **Kang, N.**, and Lee I. (2018) “Modified Augmented Lagrangian Coordination and Alternating Direction Method of Multipliers with Parallelization in Non-hierarchical Analytical Target Cascading”, *Structural and Multidisciplinary*

- [9] **Kang, N.**, Burnap, A., Kim, K. H., Reed, M. P., and Papalambros, P. Y. (2017) "Influence of Seat Form and Comfort Rating on Willingness to Pay", *International Journal of Vehicle Design*, Vol. 75, Nos. 1/2/3/4, pp.75-90.
- [8] **Kang, N.**, Feinberg, F. M., and Papalambros, P. Y. (2017) "Autonomous Electric Vehicle Sharing System Design", *Journal of Mechanical Design*, Vol. 139, No. 1, 011402.
- [7] D'Souza, K., Bayrak, A. E., **Kang, N.**, Wang, H., Altin, B., Barton, K., Hu, J., Papalambros, P. Y., Epureanu, B. I., and Gerth, R. (2016) "An Integrated Design Approach for Evaluating the Effectiveness and Cost of a Conventional and Modular Fleet", *Journal of Defense Modeling and Simulation*, Vol. 13, No. 4, pp. 381-397.
- [6] Bayrak, A., **Kang, N.\***, and Papalambros, P. Y. (2016) "Decomposition Based Design Optimization of Hybrid Electric Powertrain Architectures: Simultaneous Configuration and Sizing Design", *Journal of Mechanical Design*, Vol. 138, No. 7, 071405
- [5] **Kang, N.**, Ren, Y., Feinberg, F. M., and Papalambros, P. Y. (2016) "Public Investment and Electric Vehicle Design: A Model-based Market Analysis Framework with Application to a USA-China Comparison Study", *Design Science*, Vol. 2, e6.
- [4] **Kang, N.**, Feinberg, F. M., and Papalambros, P. Y. (2015) "Integrated Decision Making in Electric Vehicle and Charging Station Location Network Design", *Journal of Mechanical Design*, Vol. 137, No. 6, 061402.
- [3] **Kang, N.**, Kokkolaras, M., Papalambros, P. Y., Park, J., Na, W., Yoo, S., and Featherman, D. (2014) "Optimal Design of Commercial Vehicle Systems Using Analytical Target Cascading", *Structural and Multidisciplinary Optimization*, Vol. 50, No. 6, pp. 1103-1114.
- [2] **Kang, N.**, Kokkolaras, M., and Papalambros, P. Y. (2014) "Solving Multiobjective Optimization Problem Using Quasi-separable MDO Formulations and Analytical Target Cascading", *Structural and Multidisciplinary Optimization*, Vol. 50, No. 5, pp. 849-859.
- [1] **Kang, N.**, Kim, J. and Park, Y. (2007) "Integration of Marketing Domain and R&D Domain in NPD Design Process", *Industrial Management & Data Systems*, Vol. 107, No. 6, pp. 780-801.

#### Journal Papers (Korean)

- [4] **Kang, N.** (2020) "인공지능과 최적설계", *전산구조공학*, 33(1), pp. 20-22.
- [3] Lee, G., Rhim, J., **Kang, N.**, Lee, J. (2020) "자율주행 자동차의 딜레마 시나리오에서 운전자 관점의 도덕 코드", *Korea Institute of Design Research Society*, 5(1), pp. 126-135.
- [2] **Kang, N.** (2019) "제너레이티브 디자인과 인공지능 기반 설계 자동화", *기계저널*, Vol. 59, No. 8, pp. 24-28.
- [1] Kwon, Y., Byun, J., and **Kang, N.** (2019) "소형 경유 트럭에 대한 친환경 트럭으로의 개조 기술 선택에 관한 연구", *대한교통학회지*, Vol. 37, No. 2, pp. 135-147.

#### Conference Proceedings (International)

- [16] **Kang, N.\***, Yoo, S., Lee, S., Kim, S., Hwang, K. H., Park, J. H., Lee, S., Kang, M. K., Kim, C, and Jung, C. (2020) "Deep Learning-based CAD/CAE Framework", *Asian Congress of Structural and Multidisciplinary Optimization 2020 (ACSMO2020)*.
- [15] Yoo, S. and **Kang, N.\*** (2020) "Predicting Manufacturing Cost of CAD Models Using 3D CNN", *Asian Congress of Structural and Multidisciplinary Optimization 2020 (ACSMO2020)* (Poster).
- [14] Kim, S., Lee, S., and **Kang, N.\*** (2019) "AI-based Design Automation: Generative Design + Generative Models", *KSME-JSME Joint Symposium on Computational Mechanics & CAE*, Kawagoe, Japan, Sep 17-18.
- [13] Yoo, S., Lee, S., Kim, S., and **Kang, N.\*** (2019) "Gender Differences in User Experience of Autonomous Taxi Service", *The 3rd Cultural DNA Workshop 2019*, Daejeon, Korea, June 25.
- [12] Oh, S., Jung, Y., Lee, I., and **Kang, N.\*** (2018) "Design Automation by Integrating Generative Adversarial Networks and Topology Optimization", *Proceedings of the ASME 2018 International Design & Engineering Technical Conferences*, Quebec City, Quebec, Canada, Aug 26-Aug 29, DETC2018-85506.
- [11] Lee, U., **Kang, N.\***, and Lee, I. (2017) "Reliability-based Design Optimization (RBDO) for Electric Vehicle Market Systems", *Proceedings of the ASME 2017 International Design & Engineering Technical Conferences*, Charlotte, Aug 6-Aug 9, DETC2017-68045.

- [10] Jung, Y., **Kang, N.**, and Lee I. (2017) "Convergence Strategy for Parallel Solving of Analytical Target Cascading with Augmented Lagrangian Coordination", *Proceedings to the 12th World Congress on Structural and Multidisciplinary Optimization*, Braunschweig, Germany, June 5-June 9.
- [9] Min, D. A., **Kang, N.**, Rhim, J., and Lee, J. H. (2017) "A Sense of Dichotomy in Household Space and Smartphone", *The 2nd Cultural DNA Workshop 2017*, Daejeon, Korea, Jan 13.
- [8] **Kang, N.**, Bayrak, A., and Papalambros, P. Y. (2016) "A Real Options Approach to Hybrid Electric Vehicle Architecture Design for Flexibility", *Proceedings of the ASME 2016 International Design & Engineering Technical Conferences*, Charlotte, Aug 21-Aug 24, DETC2016-60247.
- [7] **Kang, N.**, Feinberg, F. M., and Papalambros, P. Y. (2015) "Autonomous Electric Vehicle Sharing System Design", *Proceedings of the ASME 2015 International Design & Engineering Technical Conferences*, Boston, Aug 2-Aug 5, DETC2015-46491 (Dow Distinguished Award)
- [6] Bayrak, A., **Kang, N.\***, and Papalambros, P. Y. (2015) "Decomposition Based Design Optimization of Hybrid Electric Powertrain Architectures: Simultaneous Configuration and Sizing Design", *Proceedings of the ASME 2015 International Design & Engineering Technical Conferences*, Boston, Aug 2-Aug 5, DETC2015-46861 (\*corresponding author)
- [5] **Kang, N.**, Emmanoulopoulos, M., Ren, Y., Feinberg, F. M., and Papalambros, P. Y. (2015) "A Framework for Quantitative Analysis of Government Policy Influence on Electric Vehicle Market", *Proceedings of the 20th International Conference on Engineering Design*, Milan, Italy, Jul 27-Jul 30, ISBN: 978-1-904670-68-1.
- [4] **Kang, N.**, Feinberg, F. M., and Papalambros, P. Y. (2014) "Integrated Decision Making in Electric Vehicle and Charging Station Location Network Design", *Proceedings of the ASME 2014 International Design & Engineering Technical Conferences*, Buffalo, Aug 17-Aug 20, doi:10.1115/DETC2014-35270.
- [3] **Kang, N.**, Feinberg, F. M., and Papalambros, P. Y. (2013) "A Framework for Enterprise-driven Product Service Systems Design", *Proceedings of the 19th International Conference on Engineering Design*, Seoul, Korea, Aug 4-Aug 7, ISBN: 978-1-904670-47-6.
- [2] **Kang, N.**, Kokkolaras, M., and Papalambros, P. Y. (2013) "Solving Multiobjective Optimization Problem Using Quasi-separable MDO Formulations and Analytical Target Cascading", *Proceedings to the 10th World Congress on Structural and Multidisciplinary Optimization*, Orlando, May 19-24.
- [1] **Kang, N.**, Kokkolaras, M., Papalambros, P. Y., Park, J., Na, W., Yoo, S., and Featherman, D. (2012) "Optimal Design of Commercial Vehicle Systems Using Analytical Target Cascading", *Proceedings of the 14th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference*, Indianapolis, Sep 17-19, AIAA 2012-5524.

#### Conference Proceedings (Korean)

- [27] Kim, E., Ryu, H., Oh, H., and **Kang, N.\*** (2020) "딥러닝을 통한 퍼스널 모빌리티 운전자 부주의 판별", 대한기계학회 2020년 학술대회.
- [26] Lee, S. and **Kang, N.\*** (2020) "딥러닝 기반 디자인 선호도 예측 및 추천시스템: 자동차 휠 사례", 대한기계학회 2020년 학술대회.
- [25] Kim, S., Lee, U., Lee, I. and **Kang, N.\*** "딥러닝을 통한 유희 차량 재배치: 공유형 자율주행전기차 시스템 최적화", 대한기계학회 2020년 학술대회.
- [24] Lee, G., Choi, M.A., and **Kang, N.\*** (2020) "자율주행 택시 승객 경험의 분위기", 대한기계학회 2020년 학술대회.
- [23] Nguyen, N.L., Jin, A., **Kang, N.**, and Jang, G. (2020) "딥러닝을 이용한 박판 빔프레임 모델의 조인트 스프링 강성 예측", 대한기계학회 2020년 학술대회.
- [22] Yoo, S. and **Kang, N.\*** (2020) "도메인 적응을 이용한 설계성능 예측 기초 연구", 대한기계학회 2020년 학술대회 (포스터)
- [21] Jwa, M.Y., Kim, E., Lee, G., Lee, J.H., Jeon, H., Seo, W., Lee, K., and **Kang, N.\*** (2020) "데이터 기반의 차량 충돌 성능 목표 수립에 대한 기초 연구", 대한기계학회 2020년 학술대회 (포스터)
- [20] Shin, D., Shin, S., and **Kang, N.\*** (2020) "서스펜션의 제너레이티브 디자인에 대한 기초 연구", 대한기계학회 2020년 학술대회 (포스터)
- [19] Jang, S. and **Kang, N.\*** (2020) "딥러닝을 통한 구조설계안 다양성 최대화", 2020 한국전산구조공학회 정기학술대회.



- [18] Yoo, S. and **Kang, N.\*** (2020) “설명가능한 인공지능 기반의 3D CAD 모델 제조원가 예측”, 대한기계학회 CAE 및 응용역학부문 2020년도 춘계학술대회.
- [17] Yoo, S., Lee, S., Kim, S., Hwang, K. H., Park, J. H., and **Kang, N.\*** (2020) “딥러닝 기반의 CAD/CAE 프레임워크”, 대한기계학회 CAE 및 응용역학부문 2020년도 춘계학술대회.
- [16] Kim, E., Youn, Y., Park, S., and **Kang, N.\*** (2020) “비정칙적인 질문으로 정치성향 예측하기: CNN 기반 설문 빅데이터 분석 기법”, Korea Computer Congress (KCC).
- [15] Kim, E., Chung, T., Jeong, E., Ryu, H., Oh, H., and **Kang, N.\*** (2020) “딥러닝 기반 퍼스널모빌리티 사용 패턴 분류”, 한국PHM학회 정기학술대회 (포스터)
- [14] **Kang, N.** (2019) “Intelligent Design Automation: AI-based Generative Design”, 2019 Winter Workshop of KSCM
- [13] Jang, S., Youn, Y., and **Kang, N.\*** (2019) “강화학습을 이용한 제너레이티브 디자인”, 대한기계학회 2019년 학술대회
- [12] Yoo, S., Lee, S., Kim, S., Kim, E., and **Kang, N.\*** (2019) “자율주행 불안감 해소를 위한 Human-AI Interaction 설계”, 대한기계학회 2019년 학술대회
- [11] Lee, S., Yoo, S., Kim, S., Kim, E., and **Kang, N.\*** (2019) “사용자 경험 데이터 주도의 자율주행 택시 기술 수용성 분석”, 대한기계학회 2019년 학술대회 (포스터)
- [10] Kim, S. and **Kang, N.\*** (2019) “서울시 자율주행 택시 서비스 디지털트윈 설계를 위한 사전 연구: 딥러닝과 빅데이터를 이용한 승객 수요 예측”, 대한기계학회 2019년 학술대회 (포스터)
- [9] Kim, S., Lee, S., Yoo, S., Kim, E., and **Kang, N.\*** (2019) “Generative Design: Engineering Design + Deep Learning”, The AI Korea 2019 컨퍼런스 (포스터).
- [8] Kim, S., Lee, S., and **Kang, N.\*** (2019) “딥러닝 기반 제너레이티브 디자인”, 대한기계학회 CAE 및 응용역학부문 2019년도 춘계학술대회.
- [7] Kim, S. and **Kang, N.\*** (2019) “이상치 탐지를 위한 오토인코더와 CNN의 비교”, 한국PHM학회 정기학술대회 (포스터).
- [6] **Kang, N.** (2019) “최적 설계 분야의 딥러닝 연구 동향”, 한국전산구조공학회 정기학술대회.
- [5] Lee, U., **Kang, N.**, and Lee, I. (2018) “Improving the Accuracy of Consumer Preference Estimation Using Economic Simulation Model”, 한국전산역학회.
- [4] Lee, U., **Kang, N.**, and Lee, I. (2017) “전기차 시장을 고려한 신뢰성 기반 최적 설계”, 대한기계학회, pp. 89-90.
- [3] Jung, Y., **Kang, N.**, and Lee, I. (2017) “Augmented Lagrangian Coordination을 이용한 Analytical Target Cascading에서의 Parallelization 도입 및 수렴전략 개발”, 대한기계학회, pp. 188-189.
- [2] Kim, J., **Kang, N.**, and Park, Y. (2009) “컨조인트와 트리즈의 통합에 관한 연구”, 기술경영경제학회, pp. 627-647.
- [1] **Kang, N.**, Kim, J. and Park, Y. (2006) “신제품 개발 프로세스에서 마케팅 영역과 제조 영역의 통합적 설계 : Conjoint 분석과 Taguchi 방법의 순차적 결합”, 한국경영과학회, Vol. 2006, No. 5, pp. 365-372.

## Book Chapters

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## REVIEWING SERVICE

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- Journal of Mechanical Design
- Structural and Multidisciplinary Optimization
- Journal of Mechanical Engineering Science
- Design Science
- Research in Engineering Design
- Systems Engineering
- Journal of Manufacturing Science and Engineering
- International Journal of Vehicle Design
- Journal of Mechanical Science and Technology
- Applied Energy
- Computers in Human Behavior
- Mechanics Based Design of Structures and Machines
- Journal of Computational Design and Engineering
- Transactions of the KSME A
- Journal of the HCI Society of Korea
- ASME International Design Engineering Technical Conference (IDETC)
- International Conference on Engineering Design (ICED)