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Department of Mechanical System Engineering
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MSDL Website
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NOVA Website
https://no-va.kr

MSDL GitHub
https://github.com/hmjeon

Research Interests

- **DNA Nanotechnology** DNA Origami, Hybrid RNA-DNA Nanoparticle, Superstructure self-assembly, Gene Therapeutics
- **Computational Mechanics** Nonlinear Finite Element Method (FEM), Shell Elements, Partition of Unity-based FEM, Composite Structure, Phase-field Modeling, Virtual Heart Modeling
- **Medical AI** Data-driven Digital Biomarkers, AI-powered Healthcare Diagnostics, Deep Learning in Medical Imaging, AI Smart Farming System

Skills

- **Programming Language***:* C++, C, C#, Python, Ruby, Swift4, MATLAB, Java, Visual Basic, PGI, Fortran 77/90, Kubernetes, Docker, Git, Subversion, MySQL, PHP
- **Parallel Computing**: CUDA, OpenACC, OpenMP, PGI CUDA Fortran
- **GUI & 3D Graphics**: PyQt, MFC, OpenGL, Streamlit
- **Finite Element Software**: ADINA, ABAQUS, ANSYS, COMSOL
- **Molecular Dynamics**: oxDNA, NAMD
- **Machine Learning**: TensorFlow, pyTorch, mmLab, scikit-learn, OpenCV, Open3D
- **OS & Cloud Computing**: Ubuntu, Red Hat, Raspbian, AWS, GCP, Azure
- **Imaging & Molecular Analysis:** EMAN2, Image J, UCSF Chimera, VMD, PyMol
- **Scientific Visualization**: Adobe Illustrator, Adobe Premiere Pro, Corel Draw, TecPlot, Paraview, Origin, Pandas

Education

2015.02 **Korea Advanced Institute of Science and Technology (KAIST)** **Korea**
Ph.D., School of Mechanical, Aerospace and Systems Engineering, Thesis: Partition of unity-based shell finite elements
(Supervisor: Prof. Phill-Seung Lee)

2008.08 **Kangwon National University** **Korea**
M.Sc., Department of Mechanical & Mechatronics Engineering, Thesis: Development of a cell-system coupled model of cardiovascular hemodynamics
(Supervisor: Prof. Eunbo Shim)

2006.08 **Kangwon National University** **Korea**
(***Summa cum laude, Graduated with first-class honors in the college of engineering / Early graduation with honor***)
B.Sc., Department of Mechanical and Mechatronics Engineering, Mechanical Engineering Program

Experience

2023.07 – 2024.12 **Jeonbuk National University** **Korea**
Associate Vice President, Innovative Graduate Affairs, Office of Research

2023.06 – Present **LINC 3.0 Center, Jeonbuk National University** **Korea**
Director, Strategic Planning Center

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2022.12 – Present **NOVA, Inc.** **Korea**
Chief Executive Officer

2022.04 – Present **Jeonbuk National University** **Korea**
Associate Professor, Department of Mechanical System Engineering

2019.12 – 2022.03 **Jeonbuk National University** **Korea**
Assistant Professor, Department of Mechanical System Engineering

2015.02 – 2019.12 **Massachusetts Institute of Technology (MIT)** **US**
Postdoctoral Associate, Department of Biological Engineering
Advisor: Prof. Mark Bathe
Development of sequence design procedure to render arbitrary 2D and 3D nanostructures using synthetic DNA

2010.07 **Oxford University** **UK**
Visiting Researcher, Centre for Mathematical Biology, Mathematical Institute. Prof. Philip Maini Laboratory
Research on a general-purpose simulation package, CASTE (Cancer, Heart, and Soft Tissue Environment)

2008.08 – Sep 2008.09 **Massachusetts Institute of Technology (MIT)** **US**
Visiting Researcher, Department of Health Sciences and Technology. Prof. Roger Mark Laboratory

2008.09 – 2009.11 **Kangwon National University** **Korea**
Researcher, Biosystems Laboratory
Development of an integrated cardiovascular system coupling a cell-system and arterial network models; Study on the effect of the age-related increase of arterial wall stiffness on the cross-bridge dynamics of the cardiac myocyte

2003.09 – 2006.08 **Kangwon National University** **Korea**
Undergraduate Research Program, Biosystems Laboratory
Development of a cardiovascular hemodynamic system model based on cardiac cells; Study on the arterial tree generation based on blood volume optimization

2000.09 – 2002.11 **Republic of Korea Marine Corps – 2nd Reconnaissance Battalion**
Military Service; Discharged upon completing military service as a sergeant

Affiliations

- Electrical Safety-Intelligence Information Graduate School
- Smart Grid Research Center
- Advanced Biomedical Imaging Center

Honors and Awards

- 논문 우수발표상, 한국풍력에너지학회 추계학술대회 (Nov 14, 2023)
- 논문 우수발표상, 한국생산제조학회 추계학술대회 (Jul 13, 2023)
- 우수 연구자상, 한국전산구조공학회 (Apr 13, 2023)
- 우수발표상, 한국풍력에너지학회 (Jun 22, 2002)
- President's Award for the Best Member with Excellent Performance and Service from the President of Korea Institute of Energy Technology Evaluation and Planning (Nov 2014)
- National Government Scholarship (2010 - 2014)
- President's Award for the top-ranked Graduation in the College of Engineering from Kangwon National University (Aug 2006)

- Kangwon National University Scholarship (2000, 2003 - 2006)
- Cheonggang Foundation Scholarship (2004)

Teaching

2020.03 – Present **Jeonbuk National University** **Korea**

- An Introduction to Deep Learning (Graduate)
- Deep Learning for Computer Vision (Graduate)
- Finite Element Analysis (Undergraduate)
- Mechanical (System) Design 1 & 2 (Undergraduate)
- Python Programming & Applications (Undergraduate)

Korea Advanced Institute of Science and Technology (KAIST) **Korea**

- *Finite Element Analysis of Structures*. Teaching Assistant.
  Prepared problem sets and exams. Assisted students individually with homework problems and helped in their understanding of class lectures (Fall 2013, Division of Ocean Systems Engineering)

Publications

[30] Lim, T., Trinh, M.C., **Jun, H.†** Partition of unity-based finite element methods for nonlinear analysis of nearly incompressible hyperelastic materials. *In Preparation*

[29] Trinh, M.C., Kim, D., Kim, M., **Jun, H.†**, Jung, L.Y. Precise Diagnosis of Acute Myocardial Infarction in the Emergency Room Using Fully Convolutional Networks-Enabled Electrocardiography. *Submitted*

[28] Trinh, M.C., **Jun, H.†** Computer-aided design software and simulation tools for scaffolded DNA nanoparticles. *Submitted*

[27] Trinh, M.C., **Jun, H.**, Duc, N.D., Thai, D.K., Kim, S.E. Stochastic static and dynamic nonlinear analysis of T12-carbon penta-graphene plates. *Submitted*

[26] Nguyen, V.H., Trinh, M.C., **Jun, H.†** Fracture behavior of thermal mismatch in functionally graded materials using phase-field modeling. Engineering Fracture Mechanics, 310:110423, 08 November 2024 (IF=4.7, JCR 11.5%) [Article]

[25] Nafo, W., Guldeniz, O., **Jun, H.**, Kim, E. Ligamentous tethering and intradiscal pressure affecting the mechanical environment of scoliotic spines. *Medical Engineering & Physics*, 104035, August 2023 (IF=2.356) [Article]

[24] Trinh, M.C. and **Jun, H.†** Stochastic bending and buckling analysis of laminated composite plates using Latin hypercube sampling. *Engineering with Computers* 39: 1459-97, April 2023 (IF=8.7, IF%=2.6) [Article]

[23] Trinh, M.C. and **Jun, H.†** Geometrically nonlinear analysis of functionally graded composite shells using MITC4 and MITC9 elements. *Thin-Walled Structures*, 185: 110632, April 2023 (IF=6.4, IF%=6.2) [Article]

[22] Wang, X., W., Li, S., **Jun, H.***(Contributed Equally), John, T., Zhang, K., Fowler, H., Doye, J., Chiu, W., Bathe, M. Planar 2D wireframe DNA origami. *Science Advances*, 8: eabn0039, 20 May 2022 (IF=14.980, IF%=8.784) [Article] [SI]

[21] Wang, X., **Jun, H.**, Bathe, M. Programming 2D supermolecular assemblies with wireframe DNA origami. *Journal of the American Chemical Society*, 144: 4403-9, 1 Mar 2022 (IF=16.383, IF%=8.659) [Article] [SI]

[20] Jung, J., **Jun, H.**, Lee, P.S. Self-updated four-node finite element using deep learning. *Computational Mechanics*, 63: 23-44, Jan 2022 (IF=4.391, IF%=9.722) [Article]

[19] **Jun, H.***, Wang, X., Parsons, M., Bricker, W., Torsten, J., Li, S., Jackson, S., Chiu, W., Bathe, M. Rapid prototyping of arbitrary 2D and 3D wireframe DNA origami. *Nucleic Acids Research*, 49(18): 10265-74, 11 Sep 2021 (IF=19.160, IF%=2.525) [Article] [SI] [ATHENA Code]

[18] **Jun, H.***, Kim, J.J., Jang, H., Park, Y., Shim, E.B. Continuum-based modeling of collective cell migration. *Journal of Mechanical Science and Technology*, 35: 4271-7, 28 Aug 2021 (IF=1.810) [Article]

[17] Trinh, M.C. and **Jun, H.**† Stochastic free vibration analysis of functionally graded beams using artificial neural networks. *Structural Engineering and Mechanics*, 78(5): 529-43, 10 Jun 2021 (IF=2.998) [Article]

[16] Trinh, M.C. and **Jun, H.**† A higher-order quadrilateral shell finite element for geometrically nonlinear analysis. *European Journal of Mechanics / A Solids*, 89: 104283, 16 Apr 2021 (IF=4.873, IF%=14.130) [Article]

[15] Kasani, P.H., Oh, S.M., Choi, Y.H., Ha, S.H., **Jun, H.**, Park, K.H., Ko, H.S., Kim, J.E., Choi, J.W., Cho, E.S., Kim, J.S. A computer vision-based approach for behavior recognition of gestating sows fed different fiber levels during high ambient temperature. *Journal of Animal Science and Technology*, 63(2): 367-79, 31 Mar 2021 (IF=2.3) [Article]

[14] Trinh, M.C., **Jun, H.**, Nguyen-Thoi, T., Nguyen, S.N. Stochastic buckling quantification of laminated composite plates using cell-based smoothed finite elements. *Thin-Walled Structures*, 163: 107674, 26 Mar 2021 (IF=6.4, IF%=6.2) [Article]

[13] **Jun, H.***, Wang, X., Parsons, M., Bricker, W., Jackson, S., Bathe, M., Rapid prototyping of wireframe scaffolded DNA origami using ATHENA. *bioRxiv* 2020.02.09.940320, 10 Feb 2020

[12] **Jun, H.***,† New higher-order triangular shell finite elements based on the partition of unity. *Structural Engineering and Mechanics*, 73: 1-16, 10 Jan 2020 (IF=2.998) [Article]

[11] **Jun, H.***, Wang, X., Bricker, W., Bathe, M. Automated sequence design of 2D wireframe DNA origami with honeycomb edges. *Nature Communications*, 10: 5419, 28 Nov 2019 (IF=17.694, IF%=7.432) [Article] [SI] [METIS Code]

Before JBNU

[10] Wamhoff1, E., Banal, J., Bricker, W., Shepherd, T., Parsons, M., Veneziano, R., Stone, M., **Jun, H.**, Wang X., Bathe, M. Programming structured DNA assemblies to probe biophysical processes. *Annual Review Biophysics*, 48: 395-419, 6 May 2019 (IF=19.763, IF%=0.694) [Article]

[09] **Jun, H.***, Shepherd, T., Zhang, K., Bricker, W., Li, S., Chiu W., Bathe, M. Automated sequence design of 3D polyhedral wireframe DNA origami with honeycomb edges. *ACS Nano*, 13: 2083-93, 3 Jan 2019 (IF=18.027, IF%=5.652) [Article] [SI] [TALOS Doc] [TALOS Code]

[08] **Jun, H.***, Zhang, F., Ratanalert, S., Shepherd, T., Qi, X., Yan, H., Bathe, M. Autonomously designed free-form 2D DNA origami. *Science Advances*, 5: eaav0655, 2 Jan 2019 (IF=14.980, IF%=8.784) [Article] [SI] [PERDIX Doc] [PERDIX Code] [MIT News] [EurekAlert] [Donga Science]

[07] **Jun, H.***,†, Mukai, P., San, K. Benchmark tests of MITC triangular shell elements. *Structural Engineering and Mechanics*, 68: 17-38, 10 Oct 2018 (IF=2.998) [Article]

[06] **Jun, H.***, Yoon, K., Bathe, K.J., Lee, P.S. The MITC3+ shell element enriched in membrane displacements by interpolation covers. *Computer Methods in Applied Mechanics and Engineering*, 337: 458-80, 1 Aug 2018 (IF=7.2, IF%=3.3%) [Article]

[05] Lee, Y., **Jeon, H.M.**, Lee, P.S., Bathe, K.J. The modal behavior of the MITC3+ triangular shell element. *Computers & Structures*, 153: 148-64, Jun 2015 (IF=5.372) [Article]

[04] **Jeon, H.M.***, Lee, Y., Lee, P.S., Bathe, K.J. The MITC3+ shell element in geometric nonlinear analysis. *Computers & Structures*, 146: 91-104, Jan 2015 (IF=5.372) [Article]

[03] **Jeon, H.M.***, Lee, P.S., Bathe, K.J. The MITC3 shell finite element enriched by interpolation covers. *Computers & Structures*, 134: 128-42, 1 Apr 2014 (IF=5.372) [Article]

[02] Shim, E.B., **Jun, H.M.**, Leem, C.H., Matusuoka, S., Noma, A. A new integrated method using a cell-hemodynamics-autonomic nerve control coupled model of the cardiovascular system. *Progress in Biophysics and Molecular Biology*, 96: 44-59, Jan-Apr 2008 (IF=6.388 in JCR 2008) [Article]

[01] **Jun, H.M.*** and Shim, E.B. Theoretical analysis of the cross-bridge sliding rate in modulating heart mechanics. *International Journal of Vascular Biomedical Engineering*, 5: 34-45, Oct 2007

Presentations

[64] Trinh, M.C., **Jun, H.**, Programming wireframe DNA nanostructures using top-down geometric specification (Invited), *19th IEEE International Conference on Nao/Micro Engineered and Molecular Systems (IEEE-NEMS 2024)*, Kyoto University of Advanced Science (KUAS), Kyoto, Japan, May 3, 2024

[63] Jung, L., Kim, DH., Kim, SH., Jun, H., Trinh, MC., Can prediction of acute myocardial infarction using a deep learning-enabled electrocardiogram be used in real-world practice? EHRA 2024, Germany Berlin, Apr 8, 2024

[62] 임태중, **전형민**, 초탄성재료 해석을 위한 PU 기반 유한요소 개발, *한국전산구조공학회 학술심포지엄*, 춘천 베어스호텔, Nov 17, 2023

[61] 웬반호이, **전형민**, Phase-field 모델을 사용한 PSZ/IN100 기능 등급 코팅의 열파괴, *한국전산구조공학회 학술심포지엄*, 춘천 베어스호텔, Nov 17, 2023

[60] 임태중, **전형민**, 한반도 풍속 변화에 따른 20MW 급 풍력터빈 구동계 최적설계, *한국풍력에너지학회 추계학술대회*, 제주 메종글래드, Nov 14, 2023

[59] SH., Kim, SH., Kim, D., Kim, S., Hong, S., Jeon, S., Kim, S., **Jun, H.**, Trinh, MC., Son, J., Yoon, WS., Lee, JY., Kim, YS., Lee, SR., Rhee, KS., Chae, JK., Kim,

WH., Jung, LY. , Prediction of acute myocardial infarction using a deep learning enabled electrocardiogram, *대한심장학회 제 67 차 추계학술대회,* 서울 그랜드워커힐, Oct 13, 2023

[58] 임태중, **전형민**, 한반도 풍속 변화에 따른 20MW 급 풍력터빈 구동계 최적설계, *한국풍력에너지학회 추계학술대회*, 제주 메종글래드, Nov 14, 2023

[57] 윤도현, 이우도, 강환구, **전형민**, 3D 스트레오비전을 활용한 딥러닝 육계 체중예측 시스템, *대한기계학회 춘계학술대회*, 전주 전북대학교 국제컨벤션센터, Apr 27, 2023

[56] **전형민**, 메디컬 트윈 가상심장 모델링, *한국전산구조공학회 정기학술대회 초청강연*, 여수 디오션리조트, 13 Apr, 2023

[55] 웬반호이, 트린민첸, **전형민**, 페이즈-필드 모델링을 통한 열충격 하중에 의한 알루미나 세라믹의 크랙 전파, *한국전산구조공학회 정기학술대회*, 여수 디오션리조트, 13 Apr, 2023

[54] 송필무, 정성진, 박대범, 심은보, **전형민**, 환자맞춤형 가상심장모델의 심근비대에 따른 비선형 모드분석, *한국전산구조공학회 정기학술대회*, 여수 디오션리조트, Apr 13, 2023

[53] 송필무, 박준혁, 정성진, 트린민첸, 류아진, 심은보, **전형민**, 이방성 초탄성 재료모델을 적용한 가상심장 모델의 모드분석, *한국전산구조공학회 학술심포지엄*, 속초 델피노리조트, Nov 25, 2022

[52] Nguyen, V.H., Trinh, M.C., **Jun, H.**, Fracture Analysis of Zirconia-Alumina Functionally Graded Material Using Phase-field Modeling, *한국전산구조공학회 학술심포지엄*, 속초 델피노리조트, Nov 25, 2022

[51] 송필무, 이병효, 임태중, **전형민**, 대형 메인베어링의 기계적성질예측에 관한 연구, *한국풍력에너지학회 춘계학술대회*, 제주 라마다프라자호텔, Jun 21, 2022

[50] 송필무, 박준혁, 정성진, 트린민첸, 심은보, **전형민**, 멀티스케일 심장수축모델을 활용한 좌심실 비대에 따른 심장역학 분석, *한국전산구조공학회 정기학술대회*, 제주 소노캄, Apr 14, 2022

[49] 트린민첸, 웬반호이, **전형민**, 2 차원 재료에 대한 확률적 탄성 속성에 관한 연구, *한국전산구조공학회 정기학술대회*, 제주 소노캄, Apr 14, 2022

[48] 윤도현, 김희진, 강환구, **전형민**, 영상분할 기법을 활용한 육계 군집의 평균 체중 예측 알고리즘 개발, *한국가금학회 추계학술대회*, 대전 컨벤션센터, Dec 5, 2021

[47] 송필무, 트린민첸, 심은보, **전형민**, 좌심실비대 모드분석을 위한 가상심장 수치모델의 개발, *한국전산구조공학회 학술심포지엄*, 해운대 신라스테이, Nov 25-26, 2021

[46] Trinh, M.C., **Jun, H.**, Probabilistic static behaviors of laminated composite plates, *한국전산구조공학회 학술심포지엄*, 해운대 신라스테이, Nov 25-26, 2021

[45] Dewangan, A., Trinh, M.C., **Jun, H.**, ATHENA: A software suite for Wireframe Scaffold DNA Origami (Invited), *The 2021 World Congress on Advances in Structural Engineering and Mechanics (ASEM21)*, Aug 25-26, 2021

[44] Trinh, M.C., **Jun, H.**, Elastic properties of lattice-like 2D materials using continuum mechanics, *The 2021 World Congress on Advances in Structural Engineering and Mechanics (ASEM21)*, Aug 23-26, 2021

[43] Dewangan, A., **Jun, H.**, Optimization of annular cavity dimensions in the circular jet burner to the enhancement of flame stability, *The 2021 World Congress on Advances in Structural Engineering and Mechanics (ASEM21)*, Aug 23-26, 2021

[42] 한종우, 트린민첸, **전형민**, 복합재 해석을 위한 Partition of Unity 기반 유한요소 개발에 관한 연구, *한국생산제조학회*, 강릉 세인트존스호텔, Jul 7-9, 2021

[41] **전형민**, 한종우, Partition of Unity 기반 유한요소를 활용한 초대형 메인 베어링의 동적응력해석, *한국풍력에너지학회 춘계학술대회*, 제주 메종글래드호텔, Jul 5-7, 2021

[40] 홍수연, **전형민**, PyFE: 4 절점 유한요소 프로그래밍, *대한기계학회 호남지회 춘계학술대회*, Jun 6, 2021

[39] 한종우, **전형민**, 풍력 대형 베어링 해석을 위한 PU 기반 유한요소 개발, *대한기계학회 호남지회 춘계학술대회*, Jun 6, 2021

[38] 윤도현, **전형민**, 딥러닝 영상분할 기법을 활용한 육계의 체중 예측에 관한 연구, *대한기계학회 호남지회 춘계학술대회*, Jun 6, 2021

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[36] 송필무, **전형민**, 박용두, 심은보, 세포 군집 이동을 모사하기 위한 연속체역학 기반 유한요소 모델링, *한국산업응용수학회 춘계학술대회*, 강릉 경포탑스텐호텔, Jun 25-27, 2021

[35] 정재호, **전형민**, 이필승, 딥러닝을 이용한 변위 적응형 유한요소 개발, *전산구조공학회 춘계학술대회*, 경주 The-K 본관, Apr 7-9, 2021

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Books

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Software & Open Source

ATHENA (A GUI toolkit for scaffolded DNA origami)
- GitHub: https://github.com/lcbb/athena/

DAEDALUS2 (**D**NA orig**a**mi S**e**quence **D**esign **A**lgorithm for **U**ser-defined **S**tructures)
- Open-source for generalized design algorithm for DX-based DNA origami
- GitHub: https://github.com/hmjeon/daedalus2-pub/

METIS (**M**echanically **E**nhanced and **T**ighten or**I**rigami **S**tructures)
- Open-source for fully autonomous design algorithm for 2D rigid arbitrary nanometer-scale wireframe
- Web Portal: https://metis-dna-origami.org/
- GitHub: https://github.com/hmjeon/metis-pub/

TALOS (**T**hree-dimensional, **A**lgorithmically generated **L**ibrary of DNA **O**rigami **S**hapes)
- Free and open-source, fully autonomous design algorithm for generating arbitrary nanometer-scale structures using DNA
- Web Portal: http://talos-dna-origami.org/
- GitHub: https://github.com/hmjeon/talos/

PERDIX (**P**rogrammed **E**ulerian **R**outing for DNA **D**es**I**gns using **X**-overs)
- Open-source resource for the fully autonomous design of arbitrary 2D scaffolded DNA origami nanostructures
- Web Portal: http://perdix-dna-origami.org/
- GitHub: https://github.com/hmjeon/perdix/

MERCURY (Nonlinear shell finite elements) This is a private repository and will be released soon

JUPITER (Nonlinear finite element based on high-performance GPU computing) This is a private repository and will be released soon

Additional 83 private repositories on GitHub

Projects

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Professional Activities

Editor, Structural Engineering and Mechanics (SEM), *An International Journal* (2021.11. ~ Present)
Director, The Korean Society of Manufacturing Technology Engineers, 탄소융합 및 경량소재 부문 (2021. 05. ~ Present)
Managing Editor, Computational Structural Engineering Institute of Korea (2020. 05 ~ 2022.04)
General Affairs Director, The Korean Society of Mechanical Engineers, Honam Branch (2020. 01. ~ 2020. 12.)
Member, International Society for Nanoscale Science, Computation and Engineering
Member, The Korean Society of Mechanical Engineers (KSME)
Member, The Korean Society of Medical & Biological Engineering (KOSOMBE)

Professional Services

Peer reviewer for journals:
Nature Computational Science
Nucleic Acids Research
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Computer Methods in Applied Mechanics and Engineering
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Structural Engineering and Mechanics
Computer Methods and Programs in Biomedicine