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Associate Professor
Department of Mechanical System Engineering
Jeonbuk National University

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MSDL Website

<https://msdl.jbnu.ac.kr>

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, Shell Finite Elements, Biomechanics, Composite Structure, Phase-field Modeling, Topology Optimization
- **Medical AI & Physical AI** Multimodal Digital Biomarkers, Generative AI & Foundation Models in Healthcare, Physical-Informed Neural Networks, Digital Twin Simulations, XAI in Medical Imaging, Precision Agriculture

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, Hugging Face Transformers, mmLab
- **LLM & Generative AI:** Core & Architectures: Transformer, Attention Mechanisms, Mixture of Experts (MoE), Multimodal LLMs, RAG & Vector Search: LangChain, LlamaIndex, RAG Pipeline Optimization | ChromaDB, Pinecone, Qdrant, Milvus, pgvector, Efficient Training & Fine-tuning: LoRA, QLoRA, PEFT, DeepSpeed, Full Fine-tuning Strategies, High-Performance Inference & Serving: vLLM, TensorRT-LLM, Model Quantization (GGUF, AWQ), Prompt Engineering & Agents: Chain-of-Thought (CoT), ReAct, Few-shot/In-context Learning, Agentic Workflows, LLMOps & Ecosystem: MLflow, Weights & Biases (W&B), Hugging Face Ecosystem, LLM Eval & Guardrails
- **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
	<i>(Summa cum laude, Graduated with first-class honors in the college of engineering / Early graduation with honor)</i>		
	B.Sc., Department of Mechanical and Mechatronics Engineering, Mechanical Engineering Program		
Experience	2023.03 – Present	Jeonbuk National University	Korea
	Head of Department, Mechanical System Engineering		
	2025.05 – Present	KIMET, Jeonbuk National University	Korea
	Associate Director, Interventional Mechano-Biotechnology Convergence Research Center		
	2025.02 – Present	Structural Engineering and Mechanics	
	Editor-in-Chief		
	2023.07 – 2024.12	Jeonbuk National University	Korea
	Associate Vice President, Innovative Graduate Affairs, Office of Research Vice Dean, Graduate School		
	2023.06 – 2025.05	LINC 3.0 Center, Jeonbuk National University	Korea
	Director, Strategic Planning Center		
	2022.12 – Present	NOVA, Inc.	Korea
	Chief Executive Officer (CEO)		
	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		

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Development of a 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

Academic Advising

- 2021.12 – 2025.02 임태중 (Taejung Lim), Master's Degree
- 2020.04 – 2023.08 송필무 (Pimu Song), Master's Degree

Affiliations

- Mechanical System Engineering (기계시스템공학부)
- Graduate School of Mechanical-Aerospace-Electric Convergence Engineering (기계·항공·전기 융합공학과)
- Electrical Safety-Intelligence Information Graduate School (전기안전·지능정보 융합대학원)
- Smart Grid Research Center (스마트그리드 연구센터)
- Advanced Biomedical Imaging Center (차세대바이오이미징 연구센터)
- Advanced Transportation Machinery Research Center (수송기계신기술 연구센터)

Honors and Awards

- 논문 우수발표상, 한국생산제조학회 추계학술대회 (Jul 18, 2025)
- 논문 우수발표상, 한국생산제조학회 추계학술대회 (Jul 18, 2025)
- Best Student Presentation Award, 한국생산제조학회 (Jul 17, 2025)

- 우수상, LAB START-UP 2024 IR 부문 우수상, 한국청년기업가정신재단 (Jan 31, 2024)
- 최우수상, 2023 년 기술창업기반 창업교육지원 IR 데모데이, 광주과학기술원 창업진흥센터(Jan 17 2024)
- 논문 우수발표상, 한국풍력에너지학회 추계학술대회 (Nov 14, 2023)
- 논문 우수발표상, 한국생산제조학회 추계학술대회 (Jul 13, 2023)
- 논문 우수 연구자상, 한국전산구조공학회 (Apr 13, 2023)
- 논문 우수발표상, 한국풍력에너지학회 (Jun 22, 2022)
- 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 Method (Undergraduate) • Mechanical Design (Undergraduate) • Python Programming (Undergraduate)	
	Korea Advanced Institute of Science and Technology (KAIST)	Korea
	• <i>Finite Element Analysis of Structures</i>. 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	[33] Nguyen, V.H., Trinh, M.C., Jun, H.[†] A phase-field modeling of dynamic ductile fracture in general shell structures. <i>Submitted</i>	
	[32] 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. <i>Submitted</i>	
	[31] Banh, T.T., Trinh, M.C., Jun, H.[†] Stability-preserving load regulation for coupled thermomechanical buckling optimization of shell structures. <i>Computer Methods in Applied Mechanics and Engineering</i> , 453:118809, 1 May 2026 (IF 6.9, JCR Top 2.6%)	
	[30] Banh, T.T., Trinh, M.C., Jun, H.[†] A novel stability-preserving load regulation scheme for thermoelastic vibration optimization. <i>Engineering with Computers</i> , 42:50, 17 Feb 2026 (IF 7.0, JCR Top 3%)	

- [29] Lim, T., Trinh, M.C., **Jun, H.**[†] Partition of unity-based tetrahedral element for nonlinear structural analysis of nearly incompressible hyperelastic materials. *Finite Elements in Analysis and Design*, 254:104464, 01 Feb 2026 (IF 3.5, JCR Top 2.9%)
- [28] Trinh, M.C., **Jun, H.**[†] Computer-aided design software and simulation tools for DNA nanoparticles. *Advanced Materials Technologies*, 11(4):e00438, 19 Feb 2026 (IF=6.2)
- [27] Trinh, M.C., **Jun, H.**^{*}(Contributed Equally), Duc, N.D., Kim, S.E., Thai, D.K., Stochastic static behaviors and dynamic responses of penta-graphene plates. *Structural Engineering and Mechanics*, 95(2):113-27, 10 June 2025 (IF=3.0) [[Article](#)]
- [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=5.3, IF%=11.4%) [[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., Ratanaalert, 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, IF%=12.9) [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, IF%=12.9) [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, IF%=12.9) [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 [88] 응우옌탄안, 트린민첸, 전형민, 12 유도 신생아 심전도(ECG) 생성을 위한 하이브리드 GNN-노이즈 제거 확산 모델, *한국 CDE 학회 동계학술대회*, 평창 모나용평, 11 Feb 2026

[87] 보꾸억타이, 트린민첸, 전형민, 스마트폰 RGB 이미지를 활용한 신생아 황달 선별검사를 위한물리학 기반 프레임워크, *한국 CDE 학회 동계학술대회*, 평창 모나용평, 11 Feb 2026

[86] 탄반티엔, 트린민첸, 전형민, Decoupled 열-역학 시스템을 위한 스펙트럼 안정성 해석, *한국 CDE 학회 동계학술대회*, 평창 모나용평, 10 Feb 2026

[85] 웬반호이, 트린민첸, 전형민, 동적 하중 하의 쉘 구조물 내 탄소성 균열 전파를 위한 Phase-field 모델링, *한국 CDE 학회 동계학술대회*, 평창 모나용평, 10 Feb 2026

- [84] 응우옌탄안, 트린민첸, **전형민**, 다중 해상도 및 공간적 GAN 기반의 12-lead 심전도 재구성, *한국생산제조학회 춘계학술대회*, 강릉 세인트존스호텔, Jul 18, 2025
- [83] 탄반티엔, 트린민첸, **전형민**, 좌굴 안전성을 고려한 열탄성 구조물의 진동 위상최적화, *한국생산제조학회 춘계학술대회*, 강릉 세인트존스호텔, Jul 18, 2025
- [82] 라자무함마드아키프, 트린민첸, **전형민**, 와이어프레임 오리가미 스캐폴드를 활용한 하이브리드 DNA-금 나노구조체 엔지니어링, *한국생산제조학회 춘계학술대회*, 강릉 세인트존스호텔, Jul 18, 2025
- [81] 웬반호이, 트린민첸, **전형민**, 위상장 모델링을 이용한 셀 구조물의 연성 파괴 해석, *한국생산제조학회 춘계학술대회*, 강릉 세인트존스호텔, Jul 18, 2025
- [80] 임태중, 트린민첸, **전형민**, Partition of Unity 기반 초탄성 유한요소모델 개발, *한국생산제조학회 춘계학술대회*, 강릉 세인트존스호텔, Jul 18, 2025
- [79] 트린민첸, **전형민**, 폐색성 심근경색 진단을 위한 딥러닝 알고리즘 개발, *한국생산제조학회 춘계학술대회*, 강릉 세인트존스호텔, Jul 18, 2025
- [78] 트린민첸, **전형민**, 심실섬유 방향이 인간 심장의 진동 모드에 미치는 영향, *한국전산구조공학회 정기학술대회*, 부산 부산대학교 건설관, Apr 03, 2025
- [77] 웬반호이, 트린민첸, **전형민**, MITC4 요소를 활용한 Phase-field 기반 셀 구조물의 동적 파괴 해석, *한국전산구조공학회 정기학술대회*, 부산 부산대학교 건설관, Apr 03, 2025
- [76] 반티엔탄, 이동규, **전형민**, 열탄성 시스템의 구조 최적화 기법 개발, *한국생산제조학회 추계학술대회*, 제주 라마다프라자호텔, Dec 13, 2024
- [75] 응우옌탄안, 트린민첸, **전형민**, 이미지 스티칭: 전통 알고리즘에서 최신 딥러닝 방식까지, *한국생산제조학회 추계학술대회*, 제주 라마다프라자호텔, Dec 13, 2024
- [74] 라자무함마드아키프, 딩바오취안, **전형민**, 화학적 결합 가지형 DNA 를 이용한 고차원 나노구조체의 효율적 조립과 다기능 나노플랫폼 개발, *한국생산제조학회 추계학술대회*, 제주 라마다프라자호텔, Dec 13, 2024
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Software & Open Source

ATHENA (A GUI toolkit for scaffolded DNA origami)

- GitHub: <https://github.com/lcbb/athena/>

DAEDALUS2 (DNA origami Sequence Design Algorithm for User-defined Structures)

- Open-source for generalized design algorithm for DX-based DNA origami
- GitHub: <https://github.com/hmjeon/daedalus2-pub/>

METIS (Mechanically Enhanced and Tighten origami Structures)

- 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/memis-pub/>

TALOS (Three-dimensional, Algorithmically generated Library of DNA Origami Shapes)

- 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 (Programmed Eulerian Routing for DNA Designs 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

An additional 83 private repositories on GitHub

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