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SUMMARY / PROFILE

Ph.D. in Mechanical Engineering with comprehensive expertise in the full lifecycle of liquid hydrogen supply chains. **Proven track record** in leading government and industrial projects, evidenced by registered patents and **five first-author publications in top-tier SCI journals (including JCR top 1%)**. Distinguishes self by integrating traditional engineering competencies such as process design (ASPEN HYSYS) and structural/thermal analysis (ABAQUS) with **cutting-edge AI/LLM methodologies** for risk assessment and design automation to solve complex engineering challenges.

EDUCATION

Ph. D. in Mechanical Engineering, Korea Advanced Institute of Science and Technology, Republic of Korea (2020. 9. ~ 2025. 2.)
- Ph. D. Thesis: *Concept of intercontinental liquid hydrogen supply chain: Electrochemical compression-based liquid hydrogen production* (Advisor: Prof. Daejun Chang)

M. S. in Mechanical Engineering, Korea Advanced Institute of Science and Technology, Republic of Korea (2018. 8. ~ 2020. 8.)
- M. S. Thesis: *Concept design of storage systems for large-scale floating liquid hydrogen hub terminal* (Advisor: Prof. Daejun Chang)

B. S. in Mechanical Engineering, Ulsan National Institute of Science and Technology, Republic of Korea (2014. 3. ~ 2018. 8.)

Gyeongsan High School, Republic of Korea (2011. 3. ~ 2014. 2.)

CAREER

• Post-Doctoral Researcher, Platform for Real-world Innovation in Smart Manufacturing and AI (PRISM), KAIST (2025. 9 ~ Present)

• Post-Doctoral Researcher, Mechanical Engineering Research Institute, Korea Advanced Institute of Science and Technology (2025. 3. ~ 2025.9)

• Teaching Assistant, Department of Mechanical Engineering, Korea Advanced Institute of Science and Technology (2019. 3. ~ 2019. 8., 2020.9. ~ 2024.8)

CORE COMPETENCIES & SKILLS

• **Green Energy System Design & Optimization**

✓ Conducted process simulation and optimization utilizing **ASPEN HYSYS** and **Genetic Algorithms**.

✓ Performed techno-economic analysis and technical feasibility studies for global hydrogen supply chains.

✓ Created engineering deliverables (PFD, P&ID) and technical documentation using AutoCAD and Visio.

• **Structural Integrity & Thermal Analysis**

✓ Designed cryogenic pressure vessels and insulation systems using **ABAQUS**.

✓ Executed design and evaluation based on international codes and standards (**ASME Design-by-Analysis**).

✓ Led the complete development cycle of storage tanks, covering design, fabrication, testing, and certification (**ASME U2 Stamp**).

• **AI & Data-Driven Engineering**

✓ Implemented design automation and optimization via **Python** and **MATLAB**.

✓ Developed **LLM-based solutions** for process risk assessment, specifically for HAZID and FMECA workflows.

SKILLS AND TECHNIQUES

• Programming: MATLAB, Python

• Process simulation: ASPEN HYSYS

• CAE: ABAQUS

• Drawing: AutoCAD, VISIO

• LLM, RAG

AWARDS AND HONORS

• Excellence Award (Marine Technology Division), 2022 Future Marine Scientist & Technologist Award Presented by The Korean Society of Marine Science and Technology Councils
(Original in Korean, 2022 년도 미래해양과학기술인상 해양기술부문 우수상 (주관: 한국해양과학기술협의회))

PUBLICATION LIST

- **Kim J**., Park H., Jung W., Chang D. Operation scenario-based design methodology for large-scale storage systems of liquid hydrogen import terminal. International Journal of Hydrogen Energy 2021; 46(80): 40262–40277. [Link]

- Choi Y[1]., **Kim J**[1]., Park S., Park H., Chang D. Design and analysis of liquid hydrogen fuel tank for heavy-duty truck. International Journal of Hydrogen Energy 2022; 47(32): 14687–14702. [Link]

- Park H., **Kim J.**, Bergan P. G., Chang D. Structural design of flexible vacuum insulation system for large-scale LH2 storage. International Journal of Hydrogen Energy 2022; 47(92): 39179–39192. [Link]

- **Kim J.**, Vu H.T.T., Kim S., Choi M., Lee E., Park K., Kim J., Park H., Choi B., Han J., Kim H., Choi J., Chang D. Technical feasibility of large-scale transportable liquid hydrogen export terminal. International Journal of Hydrogen Energy 2024; 66: 499–511. [Link]

- **Kim J**., Lee E., Vu H.T.T., Lee K., Kim H., Choi J., Han J., Park K., Kim J., Choi B., Park H., Chang D. Economic analysis of intercontinentally shipped green liquid hydrogen based on basic design of facilities in supply chain. International Journal of Hydrogen Energy 2025; 113: 39-49. [Link]

- **Kim J.**, Choi M., Jung W., Chang D. Investigation of combined process characteristics in hydrogen production and liquefaction by PEM electrolyzer and Claude cycle with liquid nitrogen precooling under varying pressure using genetic algorithm. Energy Conversion and Management 2025; 325: 119368. [Link]

- **Kim J.**, Jeong J., Chang D. Optimal shape and boil-off gas generation of fuel tank for LNG-fueled tugboat. Journal of Ocean Engineering and Technology 2020; 34(1): 19–25. [Link]

- Chang D., **Kim J.,** Park H. "Development of Liquefied Hydrogen (LH2) Storage Tanks and Safety Standards." Superconductivity and Cryogenics, 22(1), pp. 4-8, 2020. [Link]
(Original in Korean, Chang D., **Kim J.**, Park H. 액화수소 (LH2) 저장 탱크 및 안전 기준 개발 Superconductivity and Cryogenics 2020; 22(1): 4–8.)

CONFERENCE PROCEEDINGS

• **Kim J.**, Park H., Chang D. Challenges for Large Scale Liquid Hydrogen Tanker Connecting Intercontinental Hydrogen Economies. The Korean Society of Mechanical Engineers (KSME) Power and Plant Division Spring Annual Meeting. 2019
(Original in Korean, **Kim J.**, Park H., Chang D. Challenges for Large Scale Liquid Hydrogen Tanker Connecting Intercontinental Hydrogen Economies. 대한기계학회 플랜트부문 춘계학술강연회, 2019.)

• **Kim, J**., Park, H., & Chang, D. (2019). "Challenges and Solutions for Large-Scale Liquid Hydrogen Carriers Connecting the Intercontinental Hydrogen Economy." Paper presented at the Spring Conference of the Korean Hydrogen and New Energy Society (KHNES).
(Original in Korean, **김정욱**, 박현준, 장대준. 대륙간 수소경제를 연결하는 대형 액체수소 운반선박의 도전과제 및 해결방안. 한국수소및신에너지학회 춘계학술대회, 2019.)

• **Kim J.**, Park H., Chang D. Concept Design of Liquid Hydrogen Hub Terminal, KAIST- SJTU-UTokyo Joint Symposium, 2019.

• **Kim, J.,** Park, H., & Chang, D. (2019). "Infrastructure Design for Large-Scale Liquid Hydrogen Import: Operating Scenarios of a Liquid Hydrogen Hub Terminal." Paper presented at the Fall Conference of the Korean Hydrogen and New Energy Society (KHNES).
(Original in Korean, **김정욱**, 박현준, 장대준. 대용량 액체수소 수입을 위한 인프라 설계:액체수소 허브 터미널의 운영 시나리오. 한국수소및신에너지학회 추계학술대회, 2019.)

• **Kim J.**, Choi M., Jung W., Chang D. Concept design of offshore wind energy based liquid hydrogen supply chain, Asia-Pacific Forum on Renewable Energy, 2021.

• **Kim, J.,** Choi, M., Jung, W., & Chang, D. (2022). "Conceptual Design and Economic Assessment of an Offshore Wind Power-Based Liquid Hydrogen Supply Chain." Paper presented at the Joint Conference of the Korean Federation of Marine Science and Technology Societies (KOFMST).
(Original in Korean, **김정욱**, 최민수, 정원관, 장대준. 해상풍력 기반 액체수소 공급체인 개념설계 및 경제성평가, 한국해양과학기술협의회 공동학술대회, 2022)

• **Kim J.**, Park H., Jung W., Chang D. Operation scenario-based design methodology for large-scale storage systems of liquid hydrogen import terminal, 한국해양과학기술협의회 공동학술대회, 2022
(Original in Korea, **Kim J.**, Park H., Jung W., Chang D. Operation scenario-based design methodology for large-scale storage systems of liquid hydrogen import terminal, Joint Conference of the Korean Federation of Marine Science and Technology Societies (KOFMST), 2022)

• **Kim, J.,** & Chang, D. (2023). "A Study on the Design and Experimental Verification of a Non-Standard Pressure Vessel Based on the Design-by-Analysis Method of ASME Section VIII Division 2." Paper presented at the Spring Annual Meeting of the Power and Plant Division, The Korean Society of Mechanical Engineers (KSME).
(Original in Korean, **김정욱**, 장대준. ASME Section VIII Division 2 의 Design-by-Analysis 기반 비정형 압력용기 설계 및 실험적 검증에 관한 연구, 대한기계학회 플랜트부문 춘계학술대회, 2023)

• **Kim J.**, Vu H.T.T., Kim S., Choi M., Lee E., Chang D. Design of Transportable Liquid Hydrogen Terminals for Green Hydrogen Import, KAIST- SJTU-UTokyo Joint Symposium, 2023.

• **Kim J.**, Choi M., Chang D. Concept of intercontinental liquid hydrogen supply chain: Technical feasibility of liquid hydrogen transfer and vaporization in import terminals, Global Conference on Naval Architecture and Ocean Engineering, 2024.

PATENTS

• Chang, D., Park, H., & **Kim, J**. "Vacuum Insulation Device for Low Temperature Tank." PCT Application (2019).

• Chang, D., Park, H., & **Kim, J**. "Reinforced Vacuum Polyurethane Foam (RV-PUF) Insulation for Fluid Tanks." Filed in Korea (2019), Registered in Korea (2021).

• Chang, D., Park, H., & **Kim, J**. "Composite Insulation Device for Fluid Tanks (V-PUF with Powder Insulation)." Filed in Korea (2020), PCT Application (2021), Registered in Korea (2022).

• Chang, D., **Kim, J**., Kim, S., & Park, H. "Vacuum Insulated Piping (using Vacuum PUF insulation)." Filed in Korea (2021).

• Chang, D., **Kim, J**., Kim, S., Lee, E., & Choi, M. "Flexible Vacuum Insulated Pipe." Filed in Korea (2022), PCT Application (2023).

• Chang, D., & **Kim, J**. "Low Pressure Cryogenic Container." Filed in Korea (2023), PCT Application (2023).

• Chang, D., **Kim, J**., & Lee, E. "Double-Walled Liquefied Gas Storage Tank." Filed in Korea (2023).

RESEARCH PROJECTS

Bold denotes the selected projects

Selected Projects

• Development of a Liquid Hydrogen Storage Tank *(Ministry of Land, Infrastructure and Transport | 2019.06 – 2022.12)*

• Development of Core Technologies for a Commercial-Scale Liquid Hydrogen Plant *(Ministry of Land, Infrastructure and Transport | 2023.01 – 2024.12)*

✓ Developed liquid hydrogen storage tanks and systems across various capacities (0.6, 1, 18, 200 m^3).

✓ Performed structural and thermal analysis using ABAQUS, executed system design (PFD, P&ID), and managed certification and testing processes (ASME, KGS).

• Development of an Eco-Friendly 5,000 HP-class LNG-fueled Tugboat *(Ministry of Oceans and Fisheries | 2019.04 – 2020.12)*

✓ Derived optimal structural design solutions for marine LNG fuel tanks based on structural analysis and obtained KOMSA certification.

• Development of High-Efficiency Hydrogen Liquefaction Process Technology *(Ministry of Land, Infrastructure and Transport | 2019.04 – 2021.12)*

• Hydrogen Liquefaction Process Optimization and Development of Operation & Control Philosophy *(Korea Research Institute of Ships & Ocean Engineering | 2025.06 – 2025.09)*

✓ Conducted process design and dynamic simulation of hydrogen liquefaction cycles using ASPEN HYSYS.

✓ Implemented process optimization algorithms utilizing MATLAB and Genetic Algorithms.

• R&D on the Conceptual Design of a Liquid Hydrogen-Based Supply Chain *(Korea Research Institute of Ships & Ocean Engineering | 2020.04 – 2020.08)*

• Basic Design of a 75,000 m^3 Movable and Standardized Liquid Hydrogen Export Terminal and Import Terminal for Overseas Green Hydrogen *(Ministry of Trade, Industry and Energy | 2021.12 – 2024.11)*

✓ Conducted technical feasibility assessment and techno-economic analysis of the supply chain.

✓ Designed hydrogen transfer piping and water treatment systems; authored comprehensive engineering deliverables.

✓ Optimized the integrated process for hydrogen production and liquefaction.

✓ Led integrated risk assessment (HAZID) and secured AIP certification from classification societies.

• Development of Performance Evaluation Technology for Liquid Hydrogen Cargo Hold Pumps (Ministry of Trade, Industry and Energy | 2024.07 – 2030.12)

✓ Developing potential risk assessment methodologies for the initial design phase by utilizing LLM to predict potential failure modes (FMECA).

All Projects

• Development of an Integrated Operation and Control System for Offshore Drilling Rigs and a HILS-based Verification System (Ministry of Trade, Industry and Energy, 2018.11 – 2021.05)

• Development of a 2 MW-class LNG Fuel Gas Supply System (FGSS) with Embedded Equipment (Ministry of Trade, Industry and Energy, 2018.11 – 2019.08)

• Development of Control System (iCAMS) Technology for LNG-fueled and LNG Bunkering Vessels (Ministry of Trade, Industry and Energy, 2019.01 – 2019.06)

• Development of Core Technologies for a Commercial-Scale Liquid Hydrogen Plant (Ministry of Land, Infrastructure and Transport, 2023.01 – 2024.12)

• Reliability Assessment and Database Enhancement for the Basic Design of Autonomous Navigation Systems (LATTICE Technology Inc., 2025.01 – 2025.02)

• Development of Storage and Cargo Handling Technology for Heterogeneous Cargo Transport (Ministry of Oceans and Fisheries, 2024.04 – 2024.12)

• Development of an Eco-Friendly 5,000 HP-class LNG-fueled Tugboat (Ministry of Oceans and Fisheries, 2019.04 – 2020.12)

• Development of High-Efficiency Hydrogen Liquefaction Process Technology (Ministry of Land, Infrastructure and Transport, 2019.04 – 2021.12)

• Development of a Business Model Linking Renewable Energy Generation, Hydrogen Production, and Fuel Cell Power Generation (Korea Hydro & Nuclear Power, 2019.06 – 2021.05)

• Development of a Liquid Hydrogen Storage Tank (Ministry of Land, Infrastructure and Transport, 2019.06 – 2022.12)

• R&D on the Conceptual Design of a Liquid Hydrogen-Based Supply Chain (Korea Research Institute of Ships & Ocean Engineering, 2020.04 – 2020.08)

• Development of Safety Standards for the Integrated Control of Cargo Handling for Hydrogen Carriers and Fuel Supply for Hydrogen-fueled Vessels (Ministry of Oceans and Fisheries, 2020.04 – 2024.12)

• Development and Demonstration of Core Technology for a 4.8 ton/day Spray-type BOG Liquefier for Zero-Emission LNG Bunkering (Ministry of Oceans and Fisheries, 2020.04 – 2020.12)

• Manufacturing of Key Equipment and Acquisition of Class Certification for a Spray-type BOG Re-liquefaction System Pilot Plant (Ministry of Oceans and Fisheries, 2021.01 – 2022.12)

• Establishment of Design Standards for Liquid Hydrogen Carriers (LATTICE Technology Inc., 2023.01 – 2023.02)

• Basic Design of a 75,000 m³ Movable and Standardized Liquid Hydrogen Export Terminal and Import Terminal for Overseas Green Hydrogen (Ministry of Trade, Industry and Energy, 2021.12 – 2024.11)

• Development of a Steady-State Model for a Combined Liquid Hydrogen Fuel Supply and Battery System for Coastal Vessels (Ministry of Trade, Industry and Energy, 2023.09 – 2024.04)

• HAZOP Study for a 1 MW Ammonia Engine Fuel Supply System (Korea Research Institute of Ships & Ocean Engineering, 2023.02 – 2023.02)

• Development of Performance Evaluation Technology for Liquid Hydrogen Cargo Hold Pumps (Ministry of Trade, Industry and Energy, 2024.07 – 2030.12)

• Hydrogen Liquefaction Process Optimization and Development of Operation & Control Philosophy (Korea Research Institute of Ships & Ocean Engineering, 2025.06 – 2025.09)