(June 22-24, 2026 - Evanston, IL)

HIDENN-AI Summer Short Course 2026: AI-Empowered CAE for Design and Manufacturing

“Artificial Intelligence (AI) will enrich traditional approaches to modeling complex systems rather than replace them.” - Google DeepMind

The future of Computer-Aided Engineering (CAE) lies at the intersection of AI, traditional simulation, and scientific knowledge. Traditional methods alone are insufficient for increasingly complex Science and Engineering (S&E) problems. Scaling explainable predictive AI and combining it with domain-specific generative models informed by scientific knowledge and classical simulation will enable a powerful multi-agent AI system for next-generation S&E.

This two-and-a-half-day short course introduces participants to mechanistic computational intelligence (CI) tools and concepts, a new branch of AI-enhanced tools within computational S&E that explores how AI, particularly hierarchical neural networks, can be employed to tackle increasingly complex S&E problems in materials, design, manufacturing, and multi-physics, among others. Participants will learn how well-established concepts from finite element analysis (FEA) are integrated with cutting-edge agentic AI systems to quickly obtain more accurate, higher-resolution solutions, mitigate simulation errors, and automate CAE procedures.

HIDENN-AI’s technology that integrates with commercial CAE software (e.g., Abaqus and Ansys) will be applied to S&E problems where conventional methods are insufficient, such as problems with the following challenges: 1) FEA and other conventional simulation methods fail or are not suitable because the simulations take unrealistically long or require too much RAM, 2) design optimization is needed, but the influence of material or geometric parameters (even a large number of them) is not clear, 3) high accuracy is essential, or 4) rapid prototyping is required at the conceptual design stage.

What Participants Will Gain

- Familiarity in Agentic AI for CAE and how it addresses fundamental challenges in Computational S&E.
- Insights into tackling simulations that require unparalleled precision and accuracy or involve extremely large degrees of freedom via HIDENN-AI’s technology.
- Understanding of how to seamlessly integrate data-driven AI training and data-free AI solving.
- Hands-on experience with HIDENN-AI’s cutting-edge software applied to real-world industry problems through live demonstrations.

Instructors

Prof. Wing Kam Liu – Founding Advisor and Chief Strategy Officer (PhD, Caltech), Walter P Murphy Professor at Northwestern University, is a highly cited researcher and leading figure in computational mechanics. Author of Mechanistic Data Science for STEM Education and Applications and Nonlinear Finite Elements for Continua and Structures and recognized among the world’s most influential scientific minds by Thomson Reuters. He is ranked #25 globally and #15 in the U.S. in Mechanical and Aerospace Engineering (Research.com, 2024) and placed in the top 0.05% of scholars worldwide (ScholarGPS, 2024).

Prof. Dong Qian – Founding Principal and Advisor (PhD, Northwestern), Professor and Associate Department Head of Mechanical Engineering at Univ. Texas Dallas, Fellow of the American Society of Mechanical Engineers.

Dr. Gino Domel - CEO (PhD, Harvard); , **Dr. Chanwook Park** - CTO (PhD, Northwestern); **Dr. Jiachen Guo** – Chief Scientific Officer (PhD, Northwestern); , **Dr. Joseph Leonor** - Founding Director of Mechanical Eng. (PhD, Northwestern);

Registration and Tuition Information

****Tuition (US dollar): <u>In-person</u> - Early** (*before April 30*)**: $1,725, Regular** (*after April 30*)**: $1,950.** Academic discounts will apply to participants from higher institutions (**Early**: **$950**, **Regular**: **$1,150**). **<u>Remote (via Zoom)</u> - Early: $1,450**, **Regular: $1,750.** Academic discounts (**Early: $750**, **Regular: $950**). Prices listed are per person.

****Included in Tuition:** 1) Soft copy of two books authored by Dr. Liu and co-authors: “Mechanistic Data Science for STEM Education and Applications” and “Mechanistic Computational Intelligence for Engineering,” - $125 value 2) Breakfast, lunch, and coffee during the short course (in-person only).

Refund policy: Full refund minus $175 processing fee and any applicable wire transfer fee/surcharge if you withdraw before May 15, 2026. No refund will be issued after May 15, 2026.

Who can register: Researchers, scientists, engineers, faculty members, postdocs, graduate students, and upper-level undergraduates.

How to register: Click https://www.hidenn.ai/short-course/register

Venue: 1801 Maple Avenue, Evanston, IL 60201

Suggested Accommodations: **1.)** Hilton Garden Inn Chicago North Shore Evanston (2-4 min walk) **2.)** Hilton Orrington/Evanston (7-10 min walk) **3.)** Hyatt house Chicago/Evanston (12-15 min walk)

Visit the course website (www.hidenn.ai/short-course) for details. Questions: Email contact@hidenn-ai.com

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TENTATIVE COURSE SCHEDULE

Time	Day 1 (6/22)	Day 2 (6/23)	Day 3 (6/24)
6:00-7:00	-	**REPEAT FOR TIME ZONE DIFFERENCES:** HiDeNN interface with commercial program (Abaqus/Ansys) for Linear and Nonlinear Mechanics [9]	**REPEAT FOR TIME ZONE DIFFERENCES:** Tutorial: C-FEM agent
7:00-7:30	**Light breakfast and introduction**	**Light breakfast**	**Light breakfast**
7:30-8:30	Mechanistic Computational Intelligence for Science and Engineering Overview (Chapter 1-2) [1]	Ex-HiDeNN Training and Solving [10]	**I**mmersed **T**ensor **D**ecomposition (**I**TD) for arbitrary geometries
8:30-9:30	Interpolation and Neural Networks: Machine Learning with a **Hi**erarchical **De**ep Learning **N**eural **N**etwork (HiDeNN) (Chapter 3) [2,3]	Bayesian Interpolation Neural Networks: learning simulation data with uncertainty [11]	GO-MELT for fast **A**dditive **M**anufacturing (**AM**) simulation [14]
9:30-9:50	Break	Break	Break
9:50-10:50	Extending HiDeNN to **C**onvolution **HiDeNN** (C-HiDeNN) (Chapter 4) [4,5]	C-FEM agent: automatic error mitigation with only one-step remeshing	Outlook for Future/Impact of Mechanistic Computational Intelligence – One Engineering Software for the Entire Engineering Process
10:50-11:50	Extending C-HiDeNN to **C-HiDeNN** **T**ensor **D**ecomposition (C-HiDeNN-TD) - Scalability through Tensor Decomposition (Chapter 5) [6]	Solving parametric PDEs with C-HiDeNN-TD [12, 13]	-
11:50-12:50	C-HiDeNN-TD for training/learning [7,8]	Sketch to 3D geometric representation for complex geometries	-
12:50-2:00	Lunch Break	Lunch Break	-
2:00-3:00 (Repeated at 6 am tomorrow for those with time zone differences)	HiDeNN interface with commercial program (Abaqus/Ansys) for Linear and Nonlinear Mechanics [9]	Tutorial: C-FEM agent (REPEATED TOMORROW)	-

LECTURE REFERENCE PUBLICATIONS

[1] Liu, W.K., Saha, S., Domel, G., (in preparation). *Mechanistic computational intelligence for engineering.*

[2] Liu, W. K., Gan, Z., & Fleming, M. (2021). *Mechanistic data science for STEM education and applications*. Springer.

[3] Saha, S., Gan, Z., Cheng, L., Gao, J., Kafka, O. L., Xie, X., Li, H., Tajdari, M., Kim, H. A., & Liu, W. K. (2021). *Hierarchical deep learning neural network (HiDeNN): An artificial intelligence (AI) framework for computational science and engineering*. Computer Methods in Applied Mechanics and Engineering, 373, 113452. https://doi.org/10.1016/j.cma.2020.113452

[4] Park, C., Lu, Y., Saha, S., Xue, T., Guo, J., Mojumder, S., Apley, D.W., Wagner, G.J. and Liu, W.K., 2023. Convolution hierarchical deep-learning neural network (c-hidenn) with graphics processing unit (gpu) acceleration. Computational Mechanics, 72(2), pp.383-409. https://link.springer.com/article/10.1007/s00466-023-02329-4

[5] Lu, Y., Li, H., Zhang, L., Park, C., Mojumder, S., Knapik, S., Sang, Z., Tang, S., Apley, D.W., Wagner, G.J. and Liu, W.K., 2023. Convolution hierarchical deep-learning neural networks (c-hidenn): finite elements, isogeometric analysis, tensor decomposition, and beyond. Computational Mechanics, 72(2), pp.333-362. https://link.springer.com/article/10.1007/s00466-023-02336-5

[6] Li, H., Knapik, S., Li, Y., Park, C., Guo, J., Mojumder, S., Lu, Y., Chen, W., Apley, D. W., & Liu, W. K. (2023). Convolution Hierarchical Deep-Learning Neural Network Tensor Decomposition (C-HiDeNN-TD) for high-resolution topology optimization. *Computational Mechanics, 72*(2), 363–382. https://doi.org/10.1007/s00466-023-02333-8

[7] Park, C., Saha, S., Guo, J., Zhang, H., Xie, X., Bessa, M.A., Qian, D., Chen, W., Wanger, G.J., Cao, J. and Hughes, T.J., 2025. Unifying machine learning and interpolation theory via interpolating neural networks. Nature Communications, 16(1), p.8753. https://www.nature.com/articles/s41467-025-63790-8

[8] Guo, J., Park, C., Xie, X., Sang, Z., Wagner, G. J., & Liu, W. K. *(2024).* Convolutional Hierarchical Deep Learning Neural Networks-Tensor Decomposition (C-HiDeNN-TD): A scalable surrogate modeling approach for large-scale physical systems. arXiv. https://arxiv.org/abs/2409.00329

[9] Liu, Y., Park, C., Lu, Y., Mojumder, S., Liu, W.K. and Qian, D., 2023. HiDeNN-FEM: a seamless machine learning approach to nonlinear finite element analysis. Computational mechanics, 72(1), pp.173-194. https://link.springer.com/article/10.1007/s00466-023-02293-z

[10] Batley, R.T., Park, C., Liu, W.K. and Saha, S., 2025. An explainable artificial intelligence framework enabled by a separable neural architecture. *Computational Mechanics*, pp.1-21. https://link.springer.com/article/10.1007/s00466-025-02719-w

[11] Park, C., Kim, B., Guo, J. and Liu, W.K., 2026. Bayesian Interpolating Neural Network (B-INN): a scalable and reliable Bayesian model for large-scale physical systems. arXiv preprint arXiv:2601.22860. https://arxiv.org/abs/2601.22860

[12] Guo, J., Domel, G., Park, C., Zhang, H., Gumus, O.C., Lu, Y., Wagner, G.J., Qian, D., Cao, J., Hughes, T.J. and Liu, W.K., 2025. Tensor-decomposition-based a priori surrogate (taps) modeling for ultra large-scale simulations. *Computer Methods in Applied Mechanics and Engineering*, *444*, p.118101. https://www.sciencedirect.com/science/article/pii/S0045782525003731

[13] Guo, J., Park, C., Qian, D., Hughes, T.J. and Liu, W.K., 2026. Large language model-empowered next-generation computer-aided engineering. *Computer Methods in Applied Mechanics and Engineering*, *450*, p.118591. https://www.sciencedirect.com/science/article/pii/S0045782525008631

[14] Leonor, J.P. and Wagner, G.J., 2024. GO-MELT: GPU-optimized multilevel execution of LPBF thermal simulations. *Computer Methods in Applied Mechanics and Engineering*, *426*, p.116977. https://www.sciencedirect.com/science/article/pii/S0045782524002330