Hyeonghun Kim

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EDUCATION

University of California San Diego — La Jolla, CA
Ph.D. in Mechanical Engineering, GPA: 3.93/4.00 — Fall 2022–Present

Handong University — Pohang, South Korea
B.S. in Mechanical Engineering, GPA: 4.03/4.50 (Magna cum laude) — March 2015–February 2021
Minor in Electrical and Control Engineering

RESEARCH INTEREST

Reduced-order modeling, physics-informed modeling, scientific machine learning, nonlinear dynamics, uncertainty quantification, inverse problem, parameter estimation

PUBLICATIONS

1. **Kim, H** and Kramer, B. (2025). Physically consistent predictive reduced-order modeling by enhancing Operator Inference with state constraints, Journal of Computational Physics.

PREPRINTS

1. Kang, S, **Kim, H,** and Kramer, B. (2025). Parametric Operator Inference to simulate the purging process in plasma-enhanced chemical vapor deposition, arXiv:2504.03990, submitted to IEEE Transactions on Semiconductor Manufacturing.

RESEARCH PROJECTS

Kramer Research Group — La Jolla, CA
Graduate Research Assistant — September 2023–Present
Advisor: Dr. Boris Kramer

- Strong Turbulence and Rogue Wave Modeling using Machine-Learning Assisted Predictions (Ongoing)
  - We are researching the prediction and classification of capillary wave turbulence regimes via scientific machine learning methods that utilize high-resolution experimental data.
- Parametric Operator Inference to simulate the purging process in plasma-enhanced chemical vapor deposition (PECVD)
  - Using a scientific machine learning method, Operator Inference, we developed a parametric surrogate model that predicts the purging flow field within the PECVD chamber. This, trained on 36% of the data and tested on 64%, demonstrated accuracy across the entire parameter domain, with a maximum error of 9.32%, providing an effective particle contamination control solution in semiconductor manufacturing.
- Physically predictive reduced-order modeling by enhancing Operator Inference with state constraints
  - We improved the standard Operator Inference by augmenting state constraints inherent in the full-order char combustion model. This showed superior accuracy and stability to other stability-enhancing approaches, such as eigenvalue reassignment and constrained optimization. It extrapolated 200% beyond the training regime while maintaining physical consistency across the entire spatiotemporal domain and achieving a 3,584-fold speedup in online computation.

Multiagent Information Fusion and Control Lab Pohang, South Korea
Undergraduate Research Assistant July 2020–December 2020
Advisor: Dr. Won-Sang Ra

- Fast feature extraction using CNN and Hough Transformed lidar point cloud data
  - Enhanced the existing feature extraction method that used Hough transform, by (a) training the ideal features from HT using a convolutional neural network (b) using Chebyshev sampling to reduce the amount training data with respect to the range of look angles.

Energy Engineering Lab Pohang, South Korea
Undergraduate Research Assistant December 2019–June 2020
Advisor: Dr. Kwon-Yeong Lee

- Experimental study and development of a heat-resistance prediction program for automotive lamp
  - Collaborated with *SL Co.*, developed a MATLAB algorithm utilizing heat transfer and multivariate regression to predict heat resistance and inner surface temperature of automotive lamps from initial hardware conditions (CFD data provided by the company).

INTERNSHIP

ASML San Diego, CA
Graduate Intern July 2025–September 2025
Computational Fluid Dynamics Team

- The first project involved further developing a steady-state reduced-order modeling algorithm that uses machine learning techniques (linear regression, k-nearest neighbors, Kriging, and Gaussian Process regression) for the CFD simulation data, to determine the optimal method that minimizes prediction errors. The automation algorithm was integrated through the MATLAB App design.
- The second project focused on developing a transient reduced-order modeling algorithm that uses highly transient full flow-field of EUV source CFD data. By applying parametric Dynamic Mode Decomposition (DMD), we achieved high-fidelity predictions of crucial quantities, including localized species concentrations relevant to reducing tin deposition.

RELEVANT COURSEWORK

- Numerical Linear Algebra and ODE simulation
- Numerical Methods for Differential Equations
- Computational Fluid Dynamics
- Uncertainty Quantification
- Linear Systems Theory
- Optimal Estimation
- Linear Control Design
- Nonlinear Systems
- Fluid Mechanics 1
- Fluid Mechanics 2
- Conduction Heat Transfer
- Mass Transfer

COMPUTER SKILLS

- Coding: MATLAB, Python, LaTeX, Bash, Git
- Software: ANSYS, MFiX

TEACHING EXPERIENCE

Graduate Teaching Assistant at UCSD
Signals and Systems (MAE 143A) Winter 2025

Undergraduate Tutor at Handong
Calculus 2 Fall 2020

MILITARY SERVICE

Republic of Korea Army (Army Aviation Operations Command) Icheon, South Korea
Sergeant (served as a squad leader) February 2016–November 2017

Military specialty: strategy and information

Led a mentoring program in a local elementary school (Icheon Danwol Elementary School) and taught math and English to underrepresented students.

HONORS AND AWARDS

Magna Cum Laude	Feb. 2021
Academic Excellence Scholarship in School of Mechanical and Control Engineering	2020, 2019
National Science and Engineering Scholarship (Four semesters full tuition)	Spring 2019
Korea Student Aid Foundation	Spring 2018, Fall 2015