

Chia-Wei Kuo

Google-Scholar

My-Website

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EDUCATION

University of Wisconsin – Madison

Madison, WI

Ph.D. in Mechanical Engineering, Minor in Mathematics

2022

- Research: Developed Two-Phase Flow C++ CFD Solvers, Adaptive Mesh Refinement
- Sponsor: Caterpillar Inc. and Army Research Laboratory
- Honor: Phi Kappa Phi Member (Top 10% Graduate in Graduate School)

National Taiwan University

Taipei, Taiwan

M.S. in Mechanical Engineering

Jan 2016

- Research: Heat Transfer Analysis of a Totally-Enclosed Fan-Cooled Motor
- Sponsor: TECO Electric and Machinery Co.

National Cheng Kung University

Tainan, Taiwan

B.S. in Aerospace Engineering

June 2010

- Project: Design of a Hypersonic Reflective Shock Tunnel
- Sponsor: National Science Council of Taiwan
- Honor: Phi Tau Phi Member (Top 1% Undergraduate of the Engineering College)

TECHNICAL SKILLS

Computational Fluid Dynamics (CFD): OpenFOAM, Fluent, CFX, ICEMCFD, Pointwise
Programming: C++, C, FORTRAN, MATLAB

Computer-Aided Design (CAD): AutoCAD, Solidworks, Pro/E, ANSYS Workbench

Renewable Energy Engineering: TRNSYS

DOCTORAL RESEARCH

Numerical Algorithms for Two-Phase Compressible Pressure and Energy Calculations

Sponsor: Army Research Laboratory (Sep 2020 - Present)

- Developed a new two-phase flow algorithm for handling compressible flow and heat transfer calculations in engineering sprays
- Had monthly teleconferences with Army Research Lab

VoF-Lagrangian Numerical Solver for High-Fidelity Simulation of Spray Atomization Problems

Sponsor: Caterpillar Inc (Aug 2016 - Aug 2020)

- Developed a new C++ CFD numerical solver within OpenFOAM platform for conducting high-fidelity simulation of spray problems. The solver is developed based on a hybrid VoF-Lagrangian Eulerian approach
- Had regular biweekly teleconferences with Caterpillar

Statistical Model of Splashing Products from the Breakup of a Droplet

Sponsor: Caterpillar Inc (Aug 2016 - Aug 2020)

- Developed a new droplet breakup model for calculating the secondary breakup of droplets stemming from the fragmenting liquid core
- Had regular monthly teleconferences with Caterpillar

Analysis of the Performance Enhancement with Adaptive Mesh Refinement for Spray Problems

Sponsor: Caterpillar Inc (Aug 2016 - Aug 2020)

- Showed that AMR suffers degradation in performance in spray problems, and the underlying reasons are the growth in computational cell and a decline in cell-based speedup (Θ)
- Presented a theoretical analysis, leading to a novel analytical expression for the cell-based speedup, i.e., $\Theta_E = \sqrt{\kappa_{F,AMR}}/\sqrt{\kappa_{F,SM}}$, where $\kappa_{F,AMR}$ is the Frobenius condition number of the AMR, and SM corresponds to a static mesh case. The analytical findings is supported by the simulation results
- Had regular monthly teleconferences with Caterpillar

PROFESSIONAL
EXPERIENCES**University of Wisconsin – Madison**

Aug 2016 - Present

Graduate Research Assistant, Mechanical Engineering Department

- Developed new C++ numerical solvers for handling highly-resolved compressible two-phase flow simulations
- Sponsor: Caterpillar Inc, Army Research Lab

University of Wisconsin – Madison

Jan 2021 - Dec 2021

Graduate Teaching Assistant, Mechanical Engineering Department

- Assisted the grading of the graduate-level course *Computational Fluid Dynamics*
- Assisted the grading of the graduate-level course *Intermediate Fluid Dynamics*

Delta Electronics

Feb 2016 - Apr 2016

Senior Mechanical Engineer, Fan and Thermal Business Group

- Assisted the noise measurement of bathroom ventilation fans in Delta's anechoic chamber
- Designed the accessory kit packages of GBR, SMT, and SLM-series bathroom ventilation fans

National Taiwan University

Aug 2014 - Jan 2016

Graduate Research Assistant, Mechanical Engineering Department

- Performed the optimization of heat transfer of a large-scale industrial TEFC motor, making the maximum temperature below 403K and the average temperature difference below 10K
- Optimized the spacing of the fins that are installed on the motor frame through analytical approaches
- Sponsor: TECO Electric and Machinery Co.

Energy Research Center, NCKU Research Foundation

Aug 2011 - Dec 2013

Assistant Researcher, Solar Thermal Research Team

- Modeled the solar diffuse fraction distribution in Taiwan
- Designed a novel C-shaped compound parabolic solar thermal collector

Taiwan Air Force

Aug 2010 - Jul 2011

*Second Lieutenant, 3rd Air Logistics Command***National Cheng Kung University**

Feb 2009 - Jan 2010

Undergraduate Researcher

- Aided the technician in drawing 40 sheets of engineering blueprints on a hypersonic reflective shock tunnel
- Sponsor: National Science Council of Taiwan

PATENTS

M.Y. Hsu, C.H. Wang, C.H. Tsai, M.J. Huang and **C.W. Kuo**. "Motor frame with forked-typed heat dissipation channel" *Taiwan Intellectual Property Office*, IPC: F16M-001/00(2006.01), 2017.

GRADUATE
COURSEWORK**Mechanical Engineering**

- (*Fluids*) Ideal Fluid Flows, Turbulent Flows, Viscous Flows, Compressible Flows, Intermediate Fluid Dynamics
- (*Thermal*) Intermediate Thermodynamics, Advanced Thermodynamics, Heat Transfer, Heat Conduction and Radiation, Turbo Engine Principle
- (*Computation*) Computational Fluid Dynamics, High Performance Scientific Computing

Mathematics

- Methods of Computational Mathematics, Methods of Applied Mathematics, Numerical Linear Algebra

DOCTORAL COURSE
PROJECTS**Green's Function Solutions for 2D Non-Homogenous Diffusion Equations**Course: *Methods of Applied Mathematics (I)*

Nov 2018 - Dec 2018

- Derived analytical solutions to linear advection-diffusion problems using the Green's function
- Applied this approach to identify flow structures in engineering sprays

Parallelizing a Two-Phase Advection Equation Solver Using OpenMP, MPI and CUDACourse: *High Performance Scientific Computing*

Nov 2017 - Dec 2017

- Implemented multi-core, multi-node and GPU parallelizations of a two-phase advection solver
- Demonstrated a speedup of 47.5X on GPUs and 22.4X on CPUs

PUBLICATIONS

Journal Publications

1. **C.W. Kuo** and M.F. Trujillo. "An analysis of the performance enhancement with adaptive mesh refinement for spray problems." *International Journal of Multiphase Flow*, 140: 103615, 2021.
2. C.W. Tseng, **C.W. Kuo**, M.F. Trujillo and C. Rutland. "Evaluation and validation of large-eddy simulation sub-grid spray dispersion models using high-fidelity volume-of-fluid simulation data and engine combustion network experimental data." *International Journal of Engine Research*, 20(6): 583-605, 2019.
3. **C.W. Kuo** and K.C. Chang. "In-situ measurements of solar diffuse fraction in southern Taiwan," *Journal of the Chinese Institute of Engineers*, 38(6): 723-730, 2015.
4. **C.W. Kuo**, W.C. Chang and K.C. Chang. "Modeling the hourly solar diffuse fraction in Taiwan," *Renewable energy*, 66: 56-61, 2014.
5. **C.W. Kuo**, P.S. Yen, W.C. Chang and K.C. Chang. "The design and optical analysis of compound parabolic collector," *Procedia Engineering*, 79: 258-262, 2014.
6. **C.W. Kuo**, W.C. Chang and K.C. Chang. "Distribution of solar diffuse fraction in Taiwan," *Energy Procedia*, 57: 1120-1129, 2014.

Conference Proceedings

1. **C.W. Kuo** and M.F. Trujillo. "Statistical model of splashing products from the breakup of a droplet," *ILASS-Americas 31th Annual Conference on Liquid Atomization and Spray Systems*, May, 2021.
2. **C.W. Kuo** and M.F. Trujillo. "Examining the deterioration of adaptive mesh refinement performance in spray computations," *ILASS-Americas 31th Annual Conference on Liquid Atomization and Spray Systems*, May, 2021.
3. **C.W. Kuo** and M.F. Trujillo. "Speedup analysis of adaptive mesh refinement in the simulation of spray formation." *ILASS-Americas 30th Annual Conference on Liquid Atomization and Spray Systems*, Tempe, AZ, 2019.
4. **C.W. Kuo** and M.F. Trujillo. "A study of adaptive mesh refinement speedup in spray atomization." *International Multidimensional Engine Modeling Users' Group Meeting at the SAE Congress*, Detroit, MI, 2019.
5. **C.W. Kuo** and M.F. Trujillo. "Benefits of AMR for atomization calculations." *ICLASS 2018, 14th Triennial International Conference on Liquid Atomization and Spray Systems*, Chicago, IL, 2018.

6. **C.W. Kuo** and M.J. Huang. “Fin designs of TEFC motor: heat dissipation enhancement,” *The 22th National Computational Fluid Dynamics Conference*, New Taipei, Taiwan, 2015.
7. **C.W. Kuo**, P.S. Yen and K.C. Chang. “Generation of typical solar radiation 2014 year for Taiwan,” *Grand Renewable Energy*, Tokyo, Japan, 2014.
8. **C.W. Kuo**, Y.C. Liu and W.C. Chang. “Modeling of heat transfer in an industrial electric oven,” *The 20th National Computational Fluid Dynamics Conference*, Nantou, Taiwan, 2013.
9. **C.W. Kuo**, I.M. Liu and T.S. Li. “Optimization of large-scale solar thermal systems: A case study,” *The 19th National Computational Fluid Dynamics Conference*, Penghu, Taiwan, 2012.

REVIEWERS	2021 SAE International Conference on Engines & Vehicles (2 papers reviewed)	2021
	2021 ASME Internal Combustion Engine Fall Conferences (2 papers reviewed)	2021
	2020 ASME Internal Combustion Engine Fall Conferences (1 paper reviewed)	2020
	2019 Thermal and Fluids Engineering Conference (1 paper reviewed)	2019
	2017 SAE International Conference on Engines & Vehicles (1 paper reviewed)	2017
	Applied Energy Journal (IF: 8.848 as of 2021; invited reviewer)	2016

PROFESSIONAL AFFILIATIONS	SAE (Society of Automotive Engineers) International	2016 - Present
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