Chia-Wei Kuo

Google-Scholar My-Website Linkedln : 608-335-5745 : ckuo24@wisc.edu

Summary

- 3 plus years of experience in thermal/heat transfer analysis
- 4 plus years of experience in developing computational fluid dynamics (CFD) solvers
- 2 plus years of experience in computer-aided engineering (CAE) analysis
- 4 plus years of experience in two-phase flow modeling
- Experienced in CFD software, including OpenFOAM, ANSYS Fluent, and CFX for engineering simulations
- Excellent communication skills with experts from other technical fields (with 4 plus years of experience in having regular monthly teleconferences with industrial sponsors)

Education

University of Wisconsin – Madison **Madison, WI**
Ph.D. in Mechanical Engineering, Minor in Mathematics 2022
- *Research*: Developed Two-Phase Flow CFD Numerical Solvers, Adaptive Mesh Refinement
- *Sponsor*: Caterpillar (2016 - 2020), US Army Research Laboratory (2020 - Present)
- *Honor*: Phi Kappa Phi Member (Top 10% Graduate in Graduate School)

National Taiwan University **Taipei, Taiwan**
M.S. in Mechanical Engineering 2016
- *Research*: Heat Transfer and CAE Analysis of an Industrial Motor
- *Sponsor*: TECO Electric and Machinery Co. (2014 - 2016)

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

Doctoral Research

Developed CFD Solvers for Compressible Flows and Heat Transfer Simulations
Sponsor: US Army Research Laboratory (Sep 2020 - Present)
- Developed new CFD solvers for compressible flows and heat transfer simulations in engineering sprays
- Had monthly teleconferences with US Army Research Laboratory

Developed CFD Solvers for High Fidelity Simulations of Two-Phase Flow Problems
Sponsor: Caterpillar (Aug 2016 - Aug 2020)
- Developed novel C++ CFD numerical solvers within `OpenFOAM` platform for performing high-fidelity simulations of engineering sprays. The solver is developed based on a hybrid VoF-Lagrangian Eulerian approach.
- Had biweekly teleconferences with Caterpillar

Developed Models for Computing the Breakup and the Vaporization of Droplets
Sponsor: Caterpillar (Aug 2016 - Aug 2020)
- Developed a new droplet breakup model for estimating the breakup outcomes of droplets in engineering sprays
- Developed a novel Lagrangian vaporization model for calculating the vaporization of droplets
- Had monthly teleconferences with Caterpillar

Analyzed the Speedup Performance of Adaptive Mesh Refinement (AMR) Method for Spray Problems
Sponsor: Caterpillar (Aug 2016 - Aug 2020)
- Performed one of the first studies that systematically analyzed the speedup performance of the AMR method for engineering spray problems
- Proposed a novel analytical expression for the AMR speedup performance. The analytical findings are supported by the simulation results.
- Had monthly teleconferences with Caterpillar

Professional Experiences

University of Wisconsin – Madison Aug 2016 - Present
Graduate Research Assistant, Mechanical Engineering Department

- *Sponsor*: Caterpillar, US Army Research Laboratory
- *Duty 1*: Developed new C++ CFD solvers for handling highly-resolved compressible two-phase flow simulations
- *Duty 2*: Collaborated with Sandia National Laboratories in developing new Lagrangian-Eulerian spray models

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, Taiwan Feb 2016 - Apr 2016
(*Top industrial and computer fan manufacturer in Taiwan*)
Senior Mechanical Engineer, Fan and Thermal Business Group

- Assisted the noise measurement of Delta's ventilation fan products
- Designed the accessory kit packages of Delta's GBR, SMT, and SLM-series ventilation fans

National Taiwan University, Taiwan Aug 2014 - Jan 2016
Graduate Research Assistant, Mechanical Engineering Department

- *Sponsor*: TECO Electric and Machinery Co. (Top 1 industrial motor manufacturer in Taiwan)
- *Duty 1*: Enhanced the heat transfer performance of a large-scale industrial motor, making the maximum temperature below 403K and the average temperature difference below 10K
- *Duty 2*: Improved the heat transfer rate of fins that are mounted on the industrial motor frame

NCKU Research and Development Foundation, Taiwan Aug 2011 - Dec 2013
(*The leading renewable energy program sponsored by Taiwan Bureau of Energy*)
Assistant Researcher, Solar Thermal Research Team

- Improved the heat transfer performance of an industrial oven, making the temperature variation inside the oven less than 7 K.
- Analyzed the thermal efficiency of large-scale solar thermal systems
- Propose the 1^{st} model for estimating the solar thermal diffuse fractions in Taiwan

Taiwan Air Force, Taiwan Aug 2010 - Jul 2011
Second Lieutenant, 3^{rd} Air Logistics Command

Patents

M.Y. Hsu, C.H. Wang, C.H. Tsai, M.J. Huang and **C.W. Kuo**. "Motor frame with splitting type heat dissipation channel" Taiwan Intellectual Property Office, TWM537180, 2017.

Selective Publication/Reports

CFD

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.

Heat Transfer/CAE

1. **C.W. Kuo**, and M.J. Huang. "Heat dissipation enhancement of an industrial totally-enclosed-fan-cooled motor through frame designs," *Research Report, National Taiwan University*, 2016.

Engineering Modeling

1. **C.W. Kuo** and M.F. Trujillo. "A maximum entropy formalism model for the breakup of a droplet," *Physics of Fluids* (under review).

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 CUDA
Course: 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

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

FULL PUBLICATIONS

Journal Publications

1. **C.W. Kuo** and M.F. Trujillo. "A maximum entropy formalism model for the breakup of a droplet," *Physics of Fluids* (under review).
2. **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.
3. 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.
4. **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.
5. **C.W. Kuo**, W.C. Chang and K.C. Chang. "Modeling the hourly solar diffuse fraction in Taiwan," *Renewable energy*, 66: 56-61, 2014.
6. **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.
7. **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* 31^{th} *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* 31^{th} *Annual Conference on Liquid Atomization and Spray Systems*, May, 2021.
3. **C.W. Kuo** and M.F. Trujillo. "A Maximum-Entropy-Formalism for Secondary Droplet Breakup" *ILASS-Americas Annual Conference on Liquid Atomization and Spray Systems*, May, 2020.
4. **C.W. Kuo** and M.F. Trujillo. "Speedup analysis of adaptive mesh refinement in the simulation of spray formation." *ILASS-Americas* 30^{th} *Annual Conference on Liquid Atomization and Spray Systems*, Tempe, AZ, 2019.
5. **C.W. Kuo** and M.F. Trujillo. "A study of adaptive mesh refinement speedup in spray atomization." *International Multidimensional Engine Modeling Usersí Group Meeting at the SAE Congress*, Detroit, MI, 2019.
6. **C.W. Kuo** and M.F. Trujillo. "Benefits of AMR for atomization calculations." *ICLASS 2018,* 14^{th} *Triennial International Conference on Liquid Atomization and Spray Systems*, Chicago, IL, 2018.
7. **C.W. Kuo** and M.J. Huang. "Fin designs of TEFC motor: heat dissipation enhancement," *The* 22^{th} *National Computational Fluid Dynamics Conference*, New Taipei, Taiwan, 2015.
8. **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.
9. **C.W. Kuo**, Y.C. Liu and W.C. Chang. "Modeling of heat transfer in an industrial electric oven," *The* 20^{th} *National Computational Fluid Dynamics Conference*, Nantou, Taiwan, 2013.
10. **C.W. Kuo**, I.M. Liu and T.S. Li. "Optimization of large-scale solar thermal systems: A case study," *The* 19^{th} *National Computational Fluid Dynamics Conference*, Penghu, Taiwan, 2012.

Reports

1. **C.W. Kuo**, and M.J. Huang. "Heat dissipation enhancement of an industrial totally-enclosed-fan-cooled motor through frame designs," *Research Report, National Taiwan University*, 2016.