Weilong Chen

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EDUCATION

Chalmers University of Technology   Gothenburg, Sweden
M.Sc. in Engineering Mathematics and Computational Science; **GPA: 4.7/5.0**   *Aug 2022 – Jun 2024*
National University of Defense Technology   Changsha, China
B.Sc. in Aerospace Engineering; **GPA: 85/100**   *Aug 2018 – Jun 2022*
Track: Flight Vehicle Propulsion Engineering; **Supervisor:** *Mingbo Sun*

RESEARCH EXPERIENCE

Pre-mixed combustion flame prediction based on CNN-LSTM   NUDT, China
Undergraduate Research Assistant   *Oct 2019 – Aug 2020*

- Generate a trustworthy dataset through PIV system, which provides a tremendous amount of useful experimental data about 2-D laminar diffusion flame.
- Build a CNN-LSTM model to be trained and then predict the evolution of flame.
- Compared with the experimental data, it turns out the data-driven method can be effective when predicting the flame evolution, which is a complex nonlinear dynamical system. Compared with traditional CFD method, the machine learning algorithm shows computational efficiency and higher accuracy.

Research of supersonic airflow mixing and combustion scale effects   NUDT, China
Graduation thesis   *Oct 2021 – May 2022*

- **Supervisor:** Guoyan Zhao
- Establish mathematical models for the key sub-processes of fuel mixing and flame combustion in supersonic airflow, clarify the spatial scale effects of fuel injection and mixing, and the time scale effects of supersonic combustion and flame stabilization.
- Establish the scale similarity laws and analytical models for supersonic mixing and combustion, in an attempt to guide the extension of existing research findings on scaled-down combustion chambers to large scale combustion chambers.
- Conference Paper Published : China National Symposium on Combustion: 224378 (Co-first author)

WORK EXPERIENCE

Science and Technology on Scramjet Laboratory   Changsha, China
Experimental Aerodynamics R&D Intern   *Jun 2019 – Sep 2019*

- Cooperate with PhD students, mainly focusing on scramjet propulsion experiments including PIV, PLIF, Schlieren systems.
- Process the optical diagnostics experimental data.
- Deploy temperature and pressure sensors in a supersonic wind tunnel to get flow field information.
- Work on detonation engine, solid rocket engine and injection & atomization test stands. Liquid rocket engine turbine pump CAD design.

China Academy of Space Technology   Beijing, China
Engineering Intern   *Jul 2021 – Aug 2021*

- Visit space station research center and satellite manufacturing base.
- Flight vehicle optimization algorithm development and test

AVIC Engine Design Institute   Shenyang, China
Engineering Intern   *Jul 2021 – Aug 2021*

- Aeronautical engine test preparation and experiment.
- Experimental facility design and test. Master experimental safety principle.

Awards & Achievements

Social Practice and Science Contest on Energy Saving & Emission Reduction: National Thrid Award
Low-cost repeatable energy saving performance product based on combined water rocket devices
- Patent Application Number:
  The invention relates to a teaching appliance based on water rockets with propelled glider.(202110666202.x)

College Best Athelete: 400m, 800m and 4*400m champions.

University Third Scholarships: Awarded to undergraduate students who have been ranked in the top 30% at college of Aerospace Science and Engineering

Mathematical Contest Third Award: Awarded to undergraduate students who take part in mathmatical competition and rank top 10%

IELTS: Overall: 7.0 Minimal: 6.5

Projects

High Performance Computing in C Language | *GitHub*
- Stack and heap allocation; Memory fragmentation; Benchmark; Valgrind and GDB; Assembler; Inlining; Locality; Data dependency; Indirect adressing; Linux.
- Parallelism, Openmp, OpenCL, MPI, C11 Threads.

Probabilistic Machine Learning | *GitHub*
- Frequentist vs Bayesian approach; Bayesian inference; Supervised learning: Bayesian linear regression; Linear methods for classification
- Bayesian graphical models: Bayesian networks, Markov random fields, factor graphs; Belief propagation; Approximate inference and learning: Monte Carlo inference (importance sampling, Gibbs sampling, Markov chain Monte Carlo); Approximate inference: Variational inference and Expectation propagation
- Unsupervised learning: K-means clustering, the Gaussian mixture model, expectation maximization, principal component analysis

CUDA for Computaional Fluid Dynamics | *GitHub&Report*
- **Supervisor:** Lars Davidson
- Implemented CFD algorithms using the Cupy library in Python. Results showed that using a GPU with Cupy was able to significantly improve the computation time for the CFD algorithms tested. In some cases, the use of a GPU resulted in a speedup of over 110x compared to using a CPU alone. Investigations also dive into different GPUs, matrix sizes and block sizes.
- Investigations also dive into different GPUs, matrix sizes and block sizes. Comparison between Numba and Cupy.

Image Analysis | *GitHub*
- Classifiers, Filtering, Gradients, Scale, SIFT, CNN, RANSAC, Camera geometry, Triangulation, Generative neural networks, NERFs

Advanced machine learning with neural network | *Course Page*
- To be finished in Period 4
- Graph neural networks; Q-learning and Deep Q-networks; CNN; Transformers; Recurrent nets and reservoir computers; Reinforcement Learning; Black-box optimization, Gaussian processes, and Thompson sampling

Skills

Programming: C, C++, Python, MATLAB, MySQL, Linux

Tools: Git, Simulink, Pytorch, OpenFoam, CUDA, MPI, OpenCL

Others: ANSYS Fluent, Star-CCM, AutoCAD, Solidworks, Pointwise, Tecplot

Relevant Coursework

Master-level coursework: High Performance Computing, Nonlinear Optimization, CUDA for CFD, Advanced Probabilistic Machine Learning, Image Analysis, Abstract Algebra, Turbulence Modelling, Advanced Machine Learning with Neural Networks

Bachelor-level main coursework: Fluid Mechanics, CFD, Automation and Control, Combustion, Heat Tranfer, Aerodynamics, Object-Oriented Programming, Thermodynamics, Flight Mechanics, Principle of Propulsion, Numerical Analysis, PDE, Complex Analysis, Statistical Inference