Fuhong Xiao

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EDUCATION

- *Harbin Institute of Technology* — *Harbin, China*
  Master of Mechanical Engineering — Aug. 2023 - Present
  - **Core Courses**:
    Numerical Analysis, The Nonlinear Filtering and Information Fusion Theory, Impact Dynamics, Intelligent Fault Diagnosis and Fault Tolerant Control

- *Harbin Institute of Technology* — *Harbin, China*
  Bachelor of Spacecraft Environmental and Life Supporting Engineering — Sep. 2019 - Jun. 2023
  - **Core Courses**:
    Modern Control Theory, Principles of Automatic Control, Theoretical Mechanics, Structural Dynamics, Electrical Engineering, Engineering Thermodynamics

PROJECTS

- **Master Thesis: Multi-Agent Pursuit–Evasion with Residual Reinforcement Learning and Interpretable Gating**
  Sep. 2024 – Present
  Tools/Methods: ***PyTorch, CleanRL, Stable-Baselines3, Gymnasium***
  - Designed **heuristic expert policies** combining auction-based task allocation and artificial potential field motion planning
  - Proposed a prior-guided residual **multi-agent reinforcement learning** framework to refine suboptimal heuristic strategies
  - Designed an **interpretable decision-making architecture** to analyze and approximate learned multi-agent policies

- **Industry-Collaborative Project: Spacecraft Simulation and Performance Evaluation Software**
  Jun. 2023 – Dec. 2025
  Tools/Methods: ***C/C++, Python, Numerical Optimization, Orbital Mechanics***
  - Led system-level coordination and technical integration across multiple functional modules in an industry–academia collaboration
  - Developed high-fidelity orbital propagation and mission performance metric computation modules
  - Implemented spacecraft orbital **maneuver planning and optimization algorithms** to satisfy mission and fuel constraints
  - Designed a thermal field modeling approach based on **deep learning** for satellite temperature prediction

- **Industry-Collaborative Project: Planar Multi-Agent Games for Cooperative Search and Tracking**
  Jun. 2024 – Jun. 2025
  Tools/Methods: ***Python, Kalman Filtering, Multi-Agent Systems, Numerical Optimization***
  - Developed a planar multi-agent game environment for cooperative area search and target tracking tasks
  - Designed distributed region search strategies based on ant colony optimization and **reinforcement learning** to improve coverage efficiency and task allocation
  - Implemented **Kalman filter**-based target localization and state estimation under noisy observations

- **Industry-Collaborative Project: Large-Scale Constellation Satellite Observation Mission Planning**
  Jun. 2023 – Jun. 2024
  Tools/Methods: ***C++, STK (Systems Tool Kit), GA (Genetic Algorithm)***
  - Contributed to the development of an **angles-only initial orbit determinatio**n and cataloging algorithm for satellites.
  - Performed **secondary development of STK using Python** to create a test program for evaluating orbit determination accuracy.
  - Developed a method for calculating satellite limb distance under the non-spherical Earth model (WSG84).

PUBLICATIONS C=CONFERENCE, J=JOURNAL, P=PATENT, S=IN SUBMISSION, T=THESIS

[C.1] **Xiao Fuhong**, Sun Yanhong, Wang Rixin. (2024). **Close-Range Maneuver Planning for Uncontrolled Rendezvous with Multiple Elliptical Orbit Targets Based on Genetic Algorithm**. In *Journal of Physics: Conference Series*, Vol. 2762, No. 1, Article 012063. IOP Publishing. DOI: 10.1088/1742-6596/2762/1/012063.

***Abstract**: This paper addresses the challenge of on-orbit debris removal via uncontrolled rendezvous. We propose a mission planning framework using a multi-objective genetic algorithm (NSGA-II) for a sub-spacecraft to autonomously rendezvous with multiple elliptical-orbit targets without active control. The study includes dynamic modeling of the rendezvous process, parameter solution for sub-spacecraft release, and rendezvous accuracy estimation. Applied to Molniya orbit cases, the method demonstrates effective planning and reveals characteristics of optimal strategies.*

Personal Contribution: Independently derived the **relative orbital kinematics model** and designed the mission planning framework. Implemented the complete **NSGA-II-based multi-objective optimization algorithm** in Python, including decision variable encoding, constraint handling, and fitness function design. Conducted all numerical simulations and parametric analyses. Was primarily responsible for data visualization and manuscript drafting.

[C.2] Song Hongjian, **Xiao Fuhong**, Dong Yunjia, Feng Xiaoen, Lei Mingjia, Li Yuqing. (2025). **Research on Mechanical Equipment Remaining Useful Life Prediction Method Based on Attention Mechanism and Feature Fusion**. In *IFAC-PapersOnLine*, Vol. 59, Issue 20, pp. 2614–2618. IFAC. DOI: 10.1016/j.ifacol.2025.11.553.

***Abstract**: We propose a deep learning model that integrates a multi-head attention mechanism with multi-source feature fusion for predicting the remaining useful life (RUL) of mechanical equipment. The model employs LSTM to capture temporal dynamics and uses cross-attention to weight features adaptively. A feature enhancement module combines handcrafted and CNN-extracted local features to better characterize degradation. Evaluated on the C-MAPSS FD004 dataset, our method achieves superior performance in RMSE and Score metrics compared to baseline LSTM-Attention models.*

Personal Contribution: Conceptualized and designed the core neural network architecture, including the **multi-head cross-attention module** and the feature fusion pathway. Developed the end-to-end model using PyTorch, implementing data preprocessing, network training, and hyperparameter tuning pipelines.

HONORS AND AWARDS

- **First-Class University Merit-Based Scholarship**
  2023 – 2024; 2024 – 2025
  Harbin Institute of Technology
  ◦ Awarded twice for sustained academic excellence
  ◦ Ranked in the top 20% of students university-wide
- **Zhou Peiyuan Mechanics Competition**
  2021
  Provincial-Level Theoretical Mechanics Competition
  ◦ Third Prize at the provincial level
  ◦ Reflected strong ability in analytical modeling and dynamics-related problem solving
- **National Undergraduate Electronic Design Contest (UAV Track)**
  2022
  Ministry of Education of China
  ◦ First Prize at the provincial level
  ◦ Involved UAV system modeling, control logic design, and hardware–software co-design
- **Undergraduate Innovation Projects and Competitions**
  2020 – 2022
  Provincial and National Level
  ◦ Provincial First Prize in the Optoelectronic Design Contest
  ◦ Provincial Second Prize in the iCAN International Innovation and Entrepreneurship Competition
  ◦ Project selected for the National Undergraduate Innovation and Entrepreneurship Annual Conference
  ◦ Final project evaluation awarded Second Prize, emphasizing system integration and experimental validation

SKILLS

- **Programming Languages:** Python, C, C++, MATLAB
- **Robotics & Simulation:** MuJoCo, Gymnasium, Simulink, STK
- **Data Science & Machine Learning:** PyTorch, Stable-Baselines3, CleanRL, Tensorboard
- **DevOps & Version Control:** Git, Ubuntu, Docker
- **Research Skills:** Zotero, LaTeX
- **Languages:** Chinese (Native), English (Proficiency)