SONG YUHUI

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EDUCATION

China University of Petroleum, Beijing, China Aug. 2021-June. 2025

- *Bachelor of Engineering in Oil and Gas Storage and Transportation Engineering at the College of Mechanics and Transportation Engineering*
- *Areas of Expertise: Oil and Gas Storage and Transportation; Data-driven methods; Data Science; reinforcement learning; deep learning*

RESEARCH EXPERIENCE

University of Alberta Project: A Study on the Safety of Probabilistic Assessment of Pipeline Cracks and Corrosion Defects Using Effective Area Models

Visiting student at Donadeo Innovation Centre for Engineering Jan. 2024-Dec. 2024

- Cracks and corrosion defects in pipelines are considered a main threat to the safety and integrity of pipelines that can cause leakage and damage to pipelines leading to human and environmental damage. Several assessment models (e.g. CorLASTM, RSTRENG, and PSQR) were developed to assess the crack and corrosion defects to determine and ensure their safety levels. The probabilistic assessment of the defects using these models is preferred over the deterministic approach as it provides the safety level of the defects indicating the urge or the unnecessity of defects repair. The effective area of the defects produced by the assessment models to model the defects, instead of the defect detailed profile, is usually used in the probabilistic analysis using the uncertainties of the inline inspection (ILI) tools used to scan the detailed profile of the defects. Using the effective area and the ILI tools uncertainties of the actual defect profile with the modelled effective area may lead to inaccurate reliability results that can affect the safety of the analysis results. Therefore, this study is proposed to check the safety of using the effective area assessment models in the probabilistic assessment of the cracks and corrosion defects over using the detailed profile of the pipeline defects.

University of Alberta Project: Predicting Wax Deposition Problems in Offshore Pipelines Using Reinforcement Learning Models

Visiting student at Donadeo Innovation Centre for Engineering Jan. 2024-Dec. 2024

- Wax deposition in offshore pipelines presents significant challenges to operational efficiency and safety, particularly in two-phase flow conditions involving oil and water. This project investigates the application of reinforcement learning models to accurately predict wax deposition issues in these complex flow scenarios. By utilizing advanced machine learning techniques, the aim is to enhance prediction accuracy and enable proactive measures to mitigate the risks associated with wax accumulation. Ultimately, this research seeks to deepen the understanding of wax deposition mechanisms and develop effective strategies that optimize pipeline operations while ensuring safety and reliability in offshore environments.

Moscow State University Project: Unconventional Oil and Gas Reservoir Detection Deep Learning Model

Research Assistant at the Unconventional Oil and Gas Reservoir Research Lab / Jul. 2023-Sep. 2023

Научный ассистент в лаборатории исследования неконвенциональных месторождений нефти и газа

- Our project focuses on establishing a comprehensive database of deep-earth oil and gas reservoirs. Through centralized training of large-scale deep learning models, our objective is to detect unconventional oil and gas resources and evaluate their suitability for extraction. This initiative aims to enhance the scalability, systematization, and efficiency of cutting-edge extraction processes for unconventional oil and gas resources

"Challenge Cup" Entrepreneurship Plan Competition Nov. 2021-May 2022

Researcher in the Petroleum and Natural Gas Engineering Research Team

- Worked on the Marine Flexible Hose Material Entrepreneurship Project, researched new marine flexible hose materials, and planned for market introduction and entrepreneurship based on the study of the new material properties

University Student Technology Innovation Project Apr. 2022-Feb. 2023

Researcher in the Petroleum and Natural Gas Engineering Research Team

- Worked on the Hydrogen Transmission Pipeline Technology Innovation Project, integrated existing domestic and international oil and gas pipeline standards for hydrogen pipeline integrity management, and formulated a more stable and unified standard for hydrogen pipeline integrity management based on extensive engineering practices

Engineering Application Visualization Development Project Jul.2022-Nov.2022

Researcher in the Petroleum and Natural Gas Engineering Research Team

- Contributed to the Visualization Software Development Project for EI Engineering Standards, referred to the "Guidelines to Avoid Vibration-Induced Fatigue Failure in Process Pipelines" from the 2008 EI, and developed the corresponding engineering software using Python, with PyQt5 as the visualization interface

Intelligent Oil and Gas Storage and Transportation Facility Strength Design Project Mar.2023-Jun.2023

Team leader in the Oil and Gas Storage and Transportation Facility Strength Design Project

- Worked on the pipeline facility model simulation design and safety prediction under the PyTorch deep learning framework
- Collected and cleaned useful data based on encountered engineering problems during hands-on training to design oil and gas storage and transportation facilities within safety management parameters, and innovatively introduced the PyTorch deep learning neural network model to simulate facility design strength and predict safe operational duration

National College Student Physics Experiment Competition Project Mar.2023-Jul.2023

Team Leader

- Worked on the model optimization and error calibration of the commonly used Pt100 temperature measuring circuit based on the colorimetric temperature measurement method
- Innovatively compared the theoretical colorimetric temperature measurement model with actual Pt100 temperature measurement circuit results, and calibrated the systematic error of the traditional Pt100 temperature measuring circuit and, using multiphase circuits, managed to control the system error of the Pt100 temperature measurement within a deviation of 10% from the theoretical value

University Student Social Survey Practical Innovation Project Jan.2023-Mar.2023

Team Leader

- Explored the outstanding poverty alleviation model in Linyou County, Shaanxi Province
- Based on macro analysis, conducted field research in typical poverty alleviation regions and reviewed official data records, employed the more objective new hierarchical analysis method and fuzzy comprehensive evaluation method to quantify the poverty alleviation results in Linyou County, and derived insights applicable to cities with similar geographical and politico-economic foundations across the country.

INDUSTRIAL EXPERIENCE

- Researched and participated in the design of a SCADA system for real-time pipeline leak monitoring involving an automatic control theory-reinforcement learning framework.
- Conducted research and gained insights into hydrogen pipeline integrity management, encompassing aspects such as installation, maintenance, damage, and fatigue
- Developed a comprehensive understanding and introduced innovations related to the layered structure of marine flexible hoses, while strategically planning the market launch of this new innovative product
- Demonstrated proficiency in accessing, reviewing, and organizing a vast array of project-related literature and data, leveraging various technical literature search tools efficiently
- Mastered the application of select Python3 classic algorithms and visualization window programming in real-world engineering projects, with a focus on enhancing efficiency and sustainable operational optimization
- Showcased expertise in modeling real-world engineering challenges and incorporated intelligent frameworks, like deep learning, to boost model efficiency tailored to actual engineering scenarios
- Demonstrated capability in refining the theoretical Pt100 temperature measurement model and optimizing the real-world Pt100 temperature measurement circuit error
- Conducted in-depth research on safety concerns associated with hydrogen pipelines using academic articles, experimental findings, and practical engineering insights. Undertook detailed investigations into stress cracking, corrosion cracking, and obstruction-triggered explosions, and authored comprehensive review papers on these subjects

PROFESSIONAL SKILLS

- Data-science Expertise: Data-driven methods (data assimilation, big data techniques, reduced-order models), Operator inference in advanced fluid control theory
- Math-physics-theory Expertise: Mathematical physics, Abstract algebra, Distributed systems theory, Theoretical physics
- AI Expertise: Practical application of reinforcement learning and deep learning in engineering

- Software Expertise: Write classic engineering algorithms based on the specific problems using Wolfram and Python
- Documentation Expertise: Write scientific research papers (both STEM and Social Sciences) and literary articles
- Pipeline Expertise: Proficient mastery of hydrogen pipeline integrity management and marine flexible hose structures
- Research Expertise: Efficient retrieval of domestic and international scientific literature

HONORS & AWARDS

- First Place in the 2nd National Youth Innovation Translation Contest
- First Place in the Beijing Campus Contest of the "National Collegiate Physics Competition" for selected regions
- Second Place in the Campus Contest of the "National Collegiate Physics Experimental Competition"
- First Place in the "Unity in Epidemic, I'm Part of the Fight against Epidemic" essay contest with the article titled "Utmost Beauty"
- Distinction in the "IEERA Cup" International University English Vocabulary Challenge
- Distinction in the 2nd "English World Cup" National University English Vocabulary Contest
- Second-class scholarship from China University of Petroleum, Beijing
- "Merit Student" title awarded by China University of Petroleum, Beijing
- China Petroleum Engineering Design Competition Northern Region Regional Excellence Award
- China Petroleum Engineering Design Competition University-Level Third Prize