

Zehua Song (宋泽华)

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EDUCATION BACKGROUND

China University of Petroleum (Beijing) 211 Double First-Class	Beijing, China
M.S., Artificial Intelligence Average Score: 87.20/100	09/2022 – 07/2025
China University of Petroleum (Beijing)	Beijing, China
B.S., Artificial Intelligence Average Score: 90.36/100	12/2019 – 07/2022
China University of Petroleum (Beijing)	Karamay, China
Oil-gas storage and transportation engineering · Integrated Bachelor-Master Program	09/2018 – 12/2019

RESEARCH INTERESTS

AI for Science | Simulation-Driven Optimization and Uncertainty Quantification

PUBLICATIONS

Journal Articles

- **Zehua Song**, Yu Song*, Jin Yang, et al. A Multi-Objective Reinforcement Learning Framework for Real-Time Drilling Optimization Based on Symbolic Regression and Drilling Perception. *Geoenergy Science and Engineering*. 2025, 244, 213392.
- Yu Song*, **Zehua Song**, Jin Yang, et al. Multi-objective optimization framework for deepwater riser jetting installation parameters using deep reinforcement learning. *Ocean Engineering*. 2024; 309: 118398. (Featured on CCTV10)
- Yu Song*, **Zehua Song**, Jin Yang, et al. Optimization of Multi-Objective Real-Time Drilling Operations Considering Lag Effects and Formation Variability. *Reliability Engineering & System Safety*. 2025, 111138.
- Yu Song*, Jin Yang*, **Zehua Song**. Comprehensive optimization framework for deepwater surface conductor jetting parameters based on an enhanced Bayesian algorithm with Parzen estimator. *Acta Petrolei Sinica (石油学报)*. 2026, 47 (3), 641.
- Qishuai Yin*, Qikang Zhu, **Zehua Song**, et al. Deep learning based early warning methodology for gas kick of deepwater drilling using pilot-scale rig data. *Process Safety and Environmental Protection*. 2025, 106844.
- Qishuai Yin*, Laibin Zhang, Hongcheng Zhong, Boning Li, Jin Yang, Yongqi Ma, Xinye Yan, **Zehua Song**. Intelligent analysis and design of tensioned mooring system based on backpropagation neural network and genetic algorithm. *Acta Petrolei Sinica (石油学报)*. 2025, 46(5), 967.

Conference Proceedings

- Qishuai Yin*, **Zehua Song**, Kejin Chen, et al. Early warning of deep-water drilling influx based on machine learning. *International Ocean and Polar Engineering Conference: 2023*. ISOPE-I-23-005. (Presented in Vancouver, Canada)
- **Zehua Song**, Xiaoyang Yu, Yu Song*, et al. A Real-Time Inversion Framework for Carbon Equivalent Emissions in Oil and Gas Extraction Based on Vision Transformer. *International Ocean and Polar Engineering Conference: 2024*. ISOPE-I-24-044. (Presented in Rhodes, Greece)
- Kejin Chen, Jin Yang*, Qishuai Yin, Mayank Tyagi, Binzhen Gao, **Zehua Song**, et al. Digital Twin: Hybrid Virtual Simulation and Physical Monitoring Strategy for Long-Term Safe Operation of Floating Production Platform. *Offshore Technology Conference: 2024*. D041S052R007.

Under Review

- **Zehua Song**, Yu Song*, Jin Yang, et al. Hierarchical Bayesian Physics-Informed Network Modeling of Open-Hole Wellbore Instability: From Parameter Uncertainty to Reliability Assessment. *Reliability Engineering & System Safety*. (Under Review)

- Yu Song*, **Zehua Song**, Jin Yang, et al. Intelligent Prediction and Optimization of Open-Hole Wellbore Multiphysics Stability: A Synergistic PINN-DRL Approach. *International Journal of Rock Mechanics and Mining Sciences*. (Under Review)
- **Zehua Song**, Yu Song*, Jin Yang, et al. PeSNO: A Physics-embedded Stream Neural Operator as a Warm-Start Preconditioner for Mantle Convection Solvers. *American Geophysical Union Fall Meeting: 2026*. (Under Review)

PROJECT EXPERIENCE

Drill Bit Dynamics-Wear Modeling and Optimization Tool

CNOOC Shenzhen Branch Project

03/2026 – Present

- Developed a drill bit dynamics inversion and wear assessment tool for real-time estimation of bit degradation and residual life.
- Constructed a parametric 3D model of PDC bits and performed explicit dynamics simulations to evaluate cutter-rock interactions and local wear patterns.
- Implemented an implicit wear model to extrapolate long-term structural degradation and optimize blade profiles and cutter layouts.

Predictive Modeling of Coupled Platform-Mooring-Riser System for Structural Integrity

CNOOC Hainan Branch Project

04/2023 – 09/2024

- Deployed automated data acquisition systems to collect hydrological profiles at 1500-meter water depth.
- Modeled the coupled mechanical interactions among the platform, risers, and mooring lines under various environmental loads.
- Built a predictive model for mooring tension optimization under harsh sea conditions to ensure riser structural integrity.

Multi-Objective Design Optimization for Subsea Pipeline Connector

Subproject of National Key Research and Development Program of China

04/2023 – 07/2024

- Designed a multi-objective optimization algorithm using Python-ANSYS co-simulation to optimize subsea connector seal design.
- Quantified the first-order and total effects of structural parameters on key performance metrics such as contact stress and sealing force.
- Constructed response surfaces for each objective to quantitatively evaluate and select from the Pareto optimal solution set.

Bayesian Optimization for FPSO Mooring Configuration Design

4th National Ocean Engineering Design Competition

10/2022

- Modeled an FPSO dynamic mooring system in OrcaFlex and developed a multi-objective Bayesian optimization algorithm.
- Built a Python-OrcaFlex co-simulation framework to optimize the placement of counterweights and buoyancy modules.
- Obtained optimal mooring configurations satisfying multiple sea state constraints.

Machine Learning-Based Fatigue Life Prediction for Deepwater Drilling Risers

Undergraduate Thesis

01/2022 – 05/2022

- Automated dynamic riser model construction and fatigue life estimation using ANSYS parametric programs.
- Designed a physics-informed feature-crossing neural network for wave-induced fatigue life prediction.
- Applied Transfer Component Analysis to bridge simulation and field data, significantly improving model reliability.

HONORS AND AWARDS

- **Texas A&M University** – DREA Ph.D. Research Excellence Scholarship Top 4 in the Texas A&M University System 2026
- **UMass Amherst** – Research Assistantship (Declined) – \$45,162/year 2026
- **Colorado School of Mines** – Research Assistantship (Declined) – \$38,000/year 2026

- **People’s Daily** – List of 100 Exemplary Graduate Students Top 100 Nationwide 2025
- **Beijing Municipal Education Commission** – Beijing Outstanding Graduate 2025
- **CUPB** – Professional Practice Excellence Award 2025
- **Ministry of Education, PRC** – National Scholarship for Postgraduates Top 1.5% 2024
- **CUPB** – Outstanding Graduate Student Award 2023
- **China Data Analysis Society** – First Prize, National College Students Data Analysis Competition 2022
- **China Ocean Engineering Society** – Second Prize, National Ocean Engineering Design Competition 2022
- **CUPB** – First-Class Scholarship (5 consecutive years) 2020–2024
- **CUPB** – United Energy Outstanding Student Scholarship 2019

INTERNSHIPS

CNOOC Ltd. (Hainan & Tianjin)Hainan & Tianjin

Research InternSummer 2023 & 2025

- Conducted physics-based simulations for the “Deep Sea No. 1” platform using OrcaFlex and Python.
- Participated in the design of a domain-specific large model for well control risk prevention.

Kingsoft CloudBeijing

Data Science Intern07/2021 – 09/2021

- Participated in data flow and processing pipeline design for the cloud computing platform, and followed up on the implementation of data quality validation solutions.
- Wrote data cleaning and preprocessing scripts to support downstream business data usage.

CNPC Xinjiang OilfieldKaramay

Field Engineering Intern07/2019 – 08/2019

- Assisted with on-site geological and engineering data collection, organization, and preliminary analysis.

SKILLS

- **Software:** Python, MATLAB, C#, PyTorch, TensorFlow, ANSYS, COMSOL, OrcaFlex, 3ds MAX
- **Languages:** Chinese (native), English (PTE Academic 60 / Writing 75, CET-6)