

Yuncong Yang

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Research Interests

- **World models and embodied AI** — object-centric representation, diffusion/flow-matching planners
- **Underwater robot dynamics** — ROV–manipulator multibody modeling, grey-box residual correction
- **Underactuated grasping** — linkage-driven gripper modeling and reinforcement learning

Education

2024.09 – 2027.06 (expected) ■ M.Sc. in Civil and Hydraulic Engineering, Shanghai Jiao Tong University

- School of Ocean and Civil Engineering; research on world models for underwater manipulation
- Advisor: Dr. Xuyang Wang; cumulative GPA 3.22/4.0

2020.09 – 2024.06 ■ B.Eng. in Naval Architecture and Ocean Engineering, Dalian University of Technology

- Comprehensive ranking 14/89 (top 15%); weighted average 86.7/100; GPA 3.67/4.0
- Core coursework: Fluid Mechanics, CFD, Structural & Vibration Mechanics, Finite Element Analysis

Research Experience

2024 – Present ■ World-Model-Based Planning for Deep-Water Salvage ROV (C³-JEPA) — Master's thesis project
National Key R&D Program of China (2023YFC2809701)

- Developed the complete research pipeline, from data collection to closed-loop evaluation
- Benchmarked competing world-model designs — Dreamer-style latent imagination, DIAMOND diffusion models and pure JEPA — before converging on **C³-JEPA**, a cross-view, control-conditioned and context-extended design of our own
- Built a ROS–Gazebo data foundation (experimental pool, domain randomization, teleoperation GUI) and collected a large synchronized multi-modal dataset spanning multi-camera vision, proprioception and all 12 thruster / 6 gripper control channels
- Designed the observation module: frozen DINOv3-L features, temporal slot attention, SIGReg
- Formulated **C³-JEPA** (cross-view, control-conditioned, context-extended): a lightweight object-centric predictor that fuses several camera views under control conditioning and extends a short observation context to a long prediction horizon (AdaLN-Zero conditioning)
- Built a flow-matching diffusion planner with spherical-coordinate encoding and delay-compensated label shifting, plus a block-causal transformer rollout with critic-based trajectory selection
- Privileged-information experiments produced the interaction priors that now guide the observation and prediction design
- **Results:** learned slots isolate the task object and the grippers where unguided self-supervision fails outright; C³-JEPA together with the flow-matching planner roughly cuts terminal positioning error by a third and ranks candidate trajectories well above chance, with a complete salvage sequence running in closed loop
- Trained every stage on a multi-GPU cluster with systematic ablation studies; results reported in the submitted manuscript

2024 – Present ■ Grey-Box Inverse Dynamics for the Salvage ROV — branch study derived from the world-model project

- Formulated a physics-informed inverse-dynamics module coupling Fossen's 6-DOF equations with learned hydrodynamic parameters and a gated residual network, recovering thruster commands from observed vehicle motion
- Pursued as a separate line of work running alongside the world model, providing it with an interpretable motion prior

- Built a virtual-work-based kinetostatic model of a double four-bar underactuated gripper giving fast closed-form contact-force and load-capacity solutions across working conditions, and used it to assess environmental disturbance forces acting on the grasp
- Validated the solver against ADAMS simulation and an experimental gripper prototype; derived the closed-form multibody dynamics via screw theory, resolving closed kinematic loops with non-minimal coordinates and Lagrange multipliers
- Coupled the physical model with a parameter network and gated residual correction to absorb contact, friction and unmodelled hydrodynamic effects
- First-author kinetostatics paper accepted by *Robot* (《机器人》), EI-indexed, 2025; follow-up dynamics and residual-correction manuscript in preparation

Publications

1. **Y. Yang**, et al. “Rapid Salvage of Deep-Sea Underactuated Manipulators: Real-Time Solution of Contact Forces and Impact Assessment of Disturbance Forces.” *Robot* (《机器人》), **accepted**, 2025. In Chinese; EI-indexed.
2. **Y. Yang**, et al. “Underwater C³-JEPA: An Object-Centric Cross-View World Model for ROV Salvage.” *Under review*, IEEE Transactions on Automation Science and Engineering (T-ASE). Preprint: arXiv:2609.30214.
3. **Y. Yang**, et al. “Multibody Dynamics and Residual Correction for Underactuated Linkage Grippers.” In preparation.

Patents

1. **1st inventor**. Control System and Control Method for a Bionic Sea-Turtle Amphibious Vehicle. CN202310492163.5, filed 2023
2. **4th inventor**. Deep-Water Target Salvage Apparatus and Salvage Method. CN119329722B, granted 2025
3. **4th inventor**. Adaptive Underwater Adsorption Device and Underwater Salvage Apparatus. CN119262239B, granted 2025
4. **4th inventor**. Heavy Fuel Oil Heating System and Heating Method for Deep-Water Shipwrecks. CN121357744A, under examination
5. **4th inventor**. Underwater Salvage Gripper Device and Salvage Apparatus. CN119260779A, filed 2024
6. **5th inventor**. Bionic Sea-Turtle Flapping-Wing Locomotion Device. CN202310401637.0, filed 2023

Awards and Honors

- **Second Prize**, 12th National Ocean Vehicle Design and Manufacturing Competition (national final, C2 track)
- **First Prize** (E2, C2) and Third Prize (A1, E1), 12th Provincial Ocean Vehicle Competition; First and Third Prizes, 11th edition
- **S Prize**, Mathematical Contest in Modeling (MCM/ICM)
- MERIC Scholarship (2nd Class) and Academic Excellence Scholarship (2nd Class), DLUT
- President, Lingdu Boat Team, Dalian University of Technology (2022 – 2024)

Technical Skills

- **Programming**: Python / PyTorch (proficient), C, MATLAB, LaTeX
- **Robot learning**: JEPA and world models, diffusion/flow matching, RL (SAC, PPO), behavior cloning
- **Simulation**: ROS / Gazebo, UUV Simulator, Isaac Sim 4.5 + Isaac Lab
- **Hardware and CAD**: STM32 embedded development, SolidWorks, Inventor, ANSYS APDL
- **Languages**: Chinese (native), English (CET-6 508; IELTS in preparation, target 7.0 overall)

References

- **Dr. Xuyang Wang**, Professor-level Senior Engineer — Underwater Engineering Institute, School of Ocean and Civil Engineering, Shanghai Jiao Tong University. wangxuyang@sjtu.edu.cn | +86 21 3420 8071
- **Dr. Lei Qiao**, Tenure-track Associate Professor — Department of Naval Architecture and Ocean Engineering, School of Ocean and Civil Engineering, Shanghai Jiao Tong University. qiaolei@sjtu.edu.cn