

Shunyu Wu

Ph.D. Candidate — Decision-Focused Learning & Optimization

✉ shunyuwu@sjtu.edu.cn 🌐 shuanyuwu.github.io 📖 Google Scholar 🆔 ORCID 📞 +86 137 7667 7189

🎓 Education

Apr. 2022–Mar. 2026(Expected)	Ph.D. in Control Science and Engineering	Shanghai Jiao Tong University
Sep. 2019–Mar. 2022	M.Sc. in Control Engineering	Shanghai Jiao Tong University
Sep. 2015–Jun. 2019	B.Eng. in Automation	Nanjing University of Science and Technology

★ Research Works

1. Decision-Focused Learning for Water & Energy Systems

While many PtO/DFL studies remain at the benchmark level, I target **water** and **energy** systems where safety and reliability matter. I combine **graph/physics-informed** surrogates with LP/MILP optimization, yielding deployable pipelines. Unlike prior works, I validated these pipelines through **field deployments** in thermal power stations and urban water utilities.

Representative works.

- **Wu, S.**, Wang, J., Xu, H., *et al.*. End-to-End Stochastic Predict-then-Optimize for Cost-Efficient Water–Energy Scheduling. *IEEE Transactions on Smart Grid*, 2025, early access. Demonstrates stochastic PtO with measurable energy savings in coupled water–energy systems.
- **Wu, S.**, Wang, J., Xu, H., Zhao, S., Xu, J.. CritiCoder: End-to-End Uncertain Regression for Macroscopic Pressure Models in WDN. *IEEE Transactions on Computational Social Systems*, 2023, 11(2): 2222–2233. Builds uncertainty-aware surrogates for WDN pressure models, enabling robust anomaly detection.
- **Wu, S.**, Wang, J., Xu, H., *et al.*. Knowledge-based Bi-correction for Lag-Free Daily Urban Water Demand Forecasting. *Expert Systems with Applications*, 2024, 255: 124508. Hybrid knowledge+ML approach removing lag in demand forecasts; strengthens inputs to scheduling optimizers.
- **Wu, S.**, Wang, J., Rao, J., Wang, H., Xiao, X.. Planning the Invisible: End-to-End Sensor Deployment Regret Minimization for Anomaly-Aware Water Networks. *AAAI (under review)*, 2026. Introduces adjacency-aware regret to tie forecasting with optimal sensor placement in large WDNs.

Read-world field deployments. *Thermal power stations*: deployed at **330 MW (2 units)** and **660 MW (3 units)**, using 200–300 sensors with 10s sampling, stable 3+ months; efficiency +1.6–2.0%, coal –1–3 g/kWh. *Water utilities*: validated on SCADA and L-Town benchmarks; deployed at Huangpu, Shanghai, results showed energy –10%, pressure compliance +3%.

Agenda. Extend to **multi-site transferable** PtO pipelines, integrating **RL** for adaptive tuning and **LLMs** for automatic constraint extraction, ensuring transparent and reproducible deployments.

2. Dynamics of End-to-End Decision-Focused Learning

Existing work in **decision-focused learning** ignored **training dynamics**, viewing instability near boundaries as incidental. I showed that unstable dynamics fundamentally shape regret and convergence. Inspired by **computational physics**, I developed two complementary approaches: **variational free-energy** regularization to smooth separation regimes and **energy-dissipative optimizers** to restore monotone descent under inexact gradients.

Representative works.

- **Wu, S.**, Wang, J., Geng, H.. Crossing the Separation Point: Stabilizing Decision-Focused Learning with Variational Free-Energy. *ICLR (under review)*, 2025. Regularizes across separation regimes with a VFE lens, preventing collapse and improving alignment with deployment regret.
- **Wu, S.**, Wang, J., Rao, J., Xiao, X., Cai, H.. Learning as Energy Dissipation: Handling Inexact Surrogate Gradients in Decision-focused Training. *ICLR (under review)*, 2025. Introduces proximal updates with inexact surrogates, damping oscillations caused by discontinuous argmin maps.

- Xu, J., Wang, J., Zhong, Y., Rao, J., **Wu, S.** Reinforcement-Learning Controller Design for Discrete-Time Constrained Nonlinear Systems (weight initialization). *IEEE TSMC: Systems*, 2024, 54(4): 2368–2378. Training stability in closed-loop control: RL with constraint handling and careful initialization improves performance.

Agenda. Generalize stabilization methods to **unsupervised solvers**, where label scarcity amplifies instability, and explore adaptive damping schemes guided by regret signals.

3. Constrained Optimization Solver in DFL

Most DFL frameworks assume uncertainty only in objectives, leaving the **constraint side** underexplored. My work introduces **dual-gap regret** as a principled surrogate to train models with uncertain constraints, and proposes **projection-to-envelope** solvers that generate feasible decisions without supervision. This extends DFL to truly bi-parametric settings.

Representative works.

- **Wu, S.**, Wang, J.. Beyond Objective Parameters: Parametric Dual-Gap Regret for Predict-then-Optimize under Unknown Constraint Parameters. *ICLR (under review)*, 2026. Establishes dual-gap regret as a scalable objective aligning training with deployment loss under learned constraints.
- **Wu, S.** Projection-to-Envelopes Solver for Constrained Optimization. *In preparation*, 2026. Designs a label-free solver that maintains feasibility via envelope projection, making constrained optimization differentiable end-to-end.

Agenda. Develop **unsupervised neural solvers** with feasibility guarantees, and couple them with **large models** for constraint extraction to handle complex, real-world domains.

Awards

2025	China National Scholarship	Top 0.2%
2023	ABB Intelligent Technology Innovation Competition—National 1st Prize	1/194
2023	SJTU <i>Excellent Graduate Scholarship</i>	6/208
2023	SJTU <i>Merit Student</i>	Top 3%

Academic Service

2021–Present	Conference reviewing	ICLR(2025, 2026), AAAI(2026), CDC(2024, 2025), IFAC(2023) Learning-to-optimize, decision-focused pipelines, control/optimization under uncertainty.
2021–Present	Journal reviewing	IEEE TSMC (Systems), TASE, Nature Scientific Reports Methodological soundness, reproducibility, deployability, and clear reporting standards.
Ongoing	Industry collaboration	Utilities & Energy Acceptance tests, A/B, gray rollout, rollback, post-mortems—bridging prototypes to production.

Teaching & Mentoring

2023–2024	Teaching Assistant , Advanced Process Control Lectures, assignments, recitations.	SJTU
2020–Present	Mentoring & Supervision Co-mentored 1 Ph.D. and 13 M.Sc.; research pipelines and engineering replication.	SJTU / XATU / NUC

Skills

- **Languages:** Python, MATLAB, C
- **ML/DL/Modeling:** PyTorch, scikit-learn, XGBoost/LightGBM, NumPy/Pandas, PyTorch Geometric
- **Optimization:** LP/MILP, robust/stochastic, bi-level/bi-parametric, setpoint optimization; Gurobi, Pyomo
- **Systems:** configuration-driven services, hot updates, EPANET/Toolkit, SCADA, Redis, Git, Linux