Siyu(Sylvia) Dai

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Education

M.S. Candidate, Massachusetts Institute of Technology (MIT) *Sep. 2016 - Present*
Major: *Mechanical Engineering* **Cumulative GPA: 5.0/5.0**
Research Assistant in MIT Computer Science and Artificial Intelligence Laboratory (CSAIL)
Master Thesis: *Probabilistic Motion Planning and Optimization Incorporating Chance Constraints*

B.S. & **BBA, Shanghai Jiao Tong University (SJTU)** *Sep. 2012 - Jun. 2016*
Major: *Naval Architecture and Ocean Engineering* — **Overall Ranking: 1/73**
Overall GPA: 3.89/4.00 (90.6/100) Major GPA: 3.92/4.00 (91.1/100)
Bachelor Thesis: *Numerical Reconstruction and Mechanism Analysis on Vortex-Induced-Vibration of Steel Catenary Riser Caused by Platform Movement* (Awarded 2016 Excellent Bachelor Thesis (**Top 1%**) of SJTU)
Major: *Business Administration* GPA: 3.74/4.00 (88.4/100)
Bachelor Thesis: *Study of Strategy for Precision Marketing based on the WeChat Platform*

Selected Publications

Siyu Dai, Matthew Orton, Shawn Schaffert, Andreas Hofmann, and Brian Williams. "Improving Trajectory Optimization using a Roadmap Framework," *2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2018)*. Submitted.

Siyu Dai, Yadong Zeng, Feier Chen, 2016. "The Scaling Behavior of Bulk Freight Rate Volatility," *International Journal of Transport Economics*. XLIII(1-2): 85-104

Siyu Dai, Yadong Zeng, Feier Chen, Xin Zhang, Jihong Chen, Cungen Liu. "Long Memory Analysis of Bulk Freight Rate under Structural Breaks," *Proceedings of International Forum on Shipping, Ports and Airports*, 2015: 204-212.

Siyu Dai, Yadong Zeng, Feier Chen, Jihong Chen, Han Xu, Cungen Liu. "The Effect of Noise Reduction on Long Memory Test of Bulk Freight Rate Index," *Proceedings of International Forum on Shipping, Ports and Airports*, 2015: 213-219.

Siyu Dai, Yadong Zeng, Feier Chen. "Scaling Behavior of Bulk Freight Rate Volatility before and after Noise Reduction," *Journal of Shanghai Jiao Tong University (Science)*, 2016, 21(6): 655-661

Xiaoxu Ding, **Siyu Dai**, Feier Chen, Yuqi Miao, Kang Tian, Yadong Zeng, Han Xu, Cao Qin. "Long Memory and Scaling Behavior Study of Bulk Freight Rate Volatility with Structural Breaks," *Transportation Letters*, 2017. (published online: http://www.tandfonline.com/doi/full/10.1080/19427867.2016.1270718)

Leijian Song, Shixiao Fu, **Siyu Dai**, Mengmeng Zhang, Yifan Chen. "Distribution of Drag Force Coefficient along a Flexible Riser undergoing VIV in Sheared Flow," *Ocean Engineering*, 2016, 126: 1-11.

Selected Patents

A Device for Simulating Wind and Flow Loads in Model Experiment, CHN, No. 201510812078.8
A Device Using Deep-Submerged Propeller to Simulate Wind Loads, CHN, No. 201510817273.X
A Device with Variable Velocity Turning Point for Analyzing Vortex Induce Vibration (VIV) Under Two-Way Shear Flow, CHN, No. 201510916930.6
A Device with Movable Top for Tension Leg Platform VIV Analysis, CHN, No. 201510920144.3
An Angle-Adjustable Shock Absorber for Ship Docking, CHN, No. 201610057601.5
A Multi-level Buffer Device for Marine Platform, CHN, No. 201610058226.6

Scholarships and Main Awards

CC Tung Fellowship of MIT Mechanical Engineering Department	*Sep. 2016*
National Scholarship of China (**1st** out of 73, for academic and extracurricular excellence)	*Nov. 2015*
Changshi Scholarship (**Top 2** out of 73, for academic and extracurricular excellence)	*Nov. 2014*
City Scholarship of Shanghai (**Top 4** out of 245, for academic and extracurricular excellence)	*Nov. 2013*
Excellent Bachelor Thesis (**Top 1%**) of SJTU	*Jun. 2016*
Outstanding Graduates of Shanghai City	*May 2016*
Honorable Mention, COMAP Interdisciplinary Contest in Modeling	*Apr. 2015*
Second Prize, National Physics Contest for College Students (Chinese Physics Society)	*Dec. 2014*
SJTU Merit Student (**Top 3%**)	*Oct. 2014*

Selected Research Projects

Fast-reactive Risk-aware Robotic Motion Planning and Execution System Design
Advisor: Brian C. Williams, *Model-based Embedded and Robotic Systems Group*, MIT *Oct. 2017 - Present*

- Goal: To develop a risk-aware robotic motion planning system that accounts for system process noises and observation noises, and can quickly provide safe plans for robots with complicated dynamics but work under uncertainty, for instance underwater vehicles and human support robots
- Improved and tested an implementation of LQR-RRT* algorithm, and explored approaches of building probabilistic roadmaps accounting for complicated system dynamics
- Implemented the Linear Quadratic Gaussian Motion Planning (LQG-MP) algorithm on the 7-DOF Baxter arm
- Developed a TrajOpt-based probabilistic motion planner that estimates state distributions through LQG-MP, and can satisfy temporal and chance constraints for high-dimensional robotic planning tasks
- Conducted experiments on 5000 tests and showed 50% collision reduction compared to deterministic solutions
- Designed a risk-aware motion planning and execution system that can iteratively improve plans during execution time by incorporating the Iterative Risk Allocation (IRA) algorithm

Trajectory Optimization in Robot Manipulation Motion Planning
Advisor: Brian C. Williams, *Model-based Embedded and Robotic Systems Group*, MIT *Sep. 2016 - Sep. 2017*

- Goal: To analyze the strengths and weaknesses of the TrajOpt algorithm in robot motion planning, and to improve its performance by providing initial trajectories through sparse roadmaps
- Created 4 representative environments and randomly sampled 5000 pairs of kinematically feasible and collision-free start and target poses for each test environment
- Evaluated the performance of 4 sampling-based planners and the TrajOpt planner in those test cases; showed that sampling-based planners are not fast-reactive and TrajOpt alone has low success rate
- Compared and analylzed TrajOpt's performance under different costs and constraints
- Combined TrajOpt with a sparse multi-query roadmap approach, and the performance of this combined planner shows superiority over current planner in terms of speed and success rate

End-to-End Dynamic Response Analysis of Marine Flexible Slender Bodies (MFSB)
Advisor: Xuesong Xu, *Fluid Mechanics Research Laboratory*, SJTU *May 2014 - Oct. 2015*

- Goal: To analyze dynamic response of MFSB lateral oscillation and to design the optimal upper-end movement maneuver for re-entry operations, marine cable laying and deep-water towing tasks
- Established the Flexible Segment Model (FSM), which discretizes a slender body into finite segments governed by node moment equilibrium; compared numerical and experimental results to validate algorithm accuracy
- Conducted numerical analysis of 1500m MFSB and investigated influencing factors of lower-end dynamic response, including upper-end oscillation period and amplitude, as well as density and flexibility of MFSB
- Discovered minimum oscillation positions along MFSB under different upper-end oscillation conditions
- Awarded "Outstanding Research Project of Shanghai Jiao Tong University"(top 3%)

Selected Extracurricular Activities

President, Former Officer, *Graduate Association of Mechanical Engineers (GAME)*, MIT *Feb. 2017 - Present*

- Recruit GAME officers; organize officer transitions and officer social events
- Represent GAME to attend department meetings and deliver speeches during department orientation
- Host the sixth GAME annual gala, including venue reservation, funding application, publicity, etc.

Chair of Executive Committee, Former Floor Officer, *Ashdown House*, MIT *Jun. 2017 - Present*

- Lead housing-related initiatives in MIT, including changes to housing allocation policies and resident food source problem after the closure of the nearby supermarket
- Host weekly Ashdown House Executive Committee (AHEC) meetings; interview and recruit Ashdown officers

Representative of Graduates, *2016 Bachelor Degree Conferring Ceremony*, SJTU *Jun. 2016*

- Delivered a speech on behalf of 2016 graduates to express gratitude for SJTU and confidence for our new future

Representative, *SJTU Student Congress* *May 2013 - Jun. 2016*

- Collected students' opinion on academic system and campus life, and presented on the Student Congress

Skills and Interests

***Computer Skills*:** Python, Matlab, OpenRAVE, ROS, AutoCad, Abaqus, Vba, Sql
***Interests*:** Piano player (16 years), swimmer (16 years, front crawl and breaststroke), amateur yoga instructor (5 years), Chinese Kung fu (Northern style), dancer (5 performances for Dance Club with average audience of 1000+)