

# SIYU(SYLVA) DAI

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## EDUCATION

**M.S. & PhD 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*  
Teaching Assistant for *Dynamics and Control I*  
Interests: Robot Manipulation Planning, Integrated Task and Motion Planning, Optimization, Controls  
**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*

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## SELECTED PUBLICATIONS

**Siyu Dai**, Shawn Schaffert, Ashkan Jasour, Andreas Hofmann, and Brian Williams. “Chance Constrained Motion Planning for High-Dimensional Robots,” *2019 International Conference on Robotics and Automation (IRCA)*. Under review.  
**Siyu Dai**, Matthew Orton, Shawn Schaffert, Andreas Hofmann, and Brian Williams. “Improving Trajectory Optimization using a Roadmap Framework,” *Proceedings of 2018 International Conference on Intelligent Robots and Systems (IROS)*.  
Matthew Orton, **Siyu Dai**, Shawn Schaffert, Andreas Hofmann, and Brian Williams. “Improving Incremental Planning Performance through Overlapping Replanning and Execution,” *2019 International Conference on Robotics and Automation (ICRA)*. Under review.  
**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.

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## SCHOLARSHIPS AND MAIN AWARDS

CC Tung Fellowship of MIT Mechanical Engineering Department *Sep. 2016*  
National Scholarship of China (**1<sup>st</sup>** 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

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### **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 quadrature-based collision risk estimation approach and a risk reallocation method to facilitate chance constraints satisfaction for high-dimensional robotic planning tasks
- Conducted 1000 simulation tests and showed significant collision reduction compared to deterministic solutions
- Designed a risk-aware 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 analyzed 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

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

- Recruit GAME officers; organize officer transitions and officer social events
- Arrange GAME meetings with department faculty and express students' concerns
- 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
- Won Ashdown House Outstanding Officer Award of the year 2017

**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

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**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+)