Zerui Wang

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Education

Ph.D. Candidate, Mechanical & Automation Engineering, The Chinese Univ. of Hong Kong, since 2013

Cumulative GPA: 3.917/4

Research interests:

Safety mechanism design in robotic surgery

Visual servoing in robotic surgery (soft tissue manipulation, dissection and suturing)

Exchange in Europe, Summer 2012

TU Delft, VUB, U-PSUD, ECP, ISAE

Most selective elite delegation among students in Beihang University (top 0.75%)

B.Eng. Degree, Quality and Reliability Engineering, Beihang University, 2009-2013

Overall GPA: 3.84/4 (90.04/100), rank **1st** in School of Reliability & System Engineering

Senior high school student, Urumqi No.1 Senior High School, 2006-2009

Top 0.18% in the National College Entrance Examination

The 1st Prize in National Olympiad in Informatics

The 2nd Prize in Chinese Physics Olympiad

Honors & Awards

- Awardee of Hong Kong PhD Fellowship — Aug. 2013
- Champion of Innovative Underwater Robot Design RoboCup Open (China) — Nov. 2012
- The 2nd-Prize in National University Mechanical Innovation Competition (10%) — Jul. 2012
- The 2nd-Prize in National Undergraduate Physics Competition (7.5%) — Dec. 2010
- National Scholarship for University Students (2.6%) — Nov. 2010
- Excellent Students Awards of Beijing (1.1%) — Nov. 2011
- Elite Student of Beihang University (3%) — Nov. 2011
- Outstanding Student Award, *Yang Weimin* Special Scholarship (0.8%) — Mar. 2012
- The 2nd-Prize Scholarship of Academic Contest (3%) — Dec. 2011
- The 1st-Prize Scholarship of Science and Engineering Contest (7%) — 2010-2012
- The 1st-Prize Scholarship of Academic Performance (3%) — 2010-2012

Projects

Undergraduate

Bio-inspired Autonomous Robotic Fish, Intelligence Control Laboratory, Peking University, RA, Advisor: *Prof. Guangming Xie* (Jun. 2012 – Jun. 2013)

Mechanical design of the new version biomimetic fish robot with SolidWorks;

Design the pressure sensor unit;

Complete online Particle Swarm Optimization (PSO) and the pectoral fin optimization experiment;

Analyze the motion and build the simplified kinetics model of the bio-inspired autonomous robotic fish.

Multifunctional Wall-Climbing Platform, Innovation Internship Center, Beihang University, RA, Key team member, Advisor: *Prof. Guiping Jing* (Sep. 2011 – Jul.2012)

Participate in function design, employ innovative approach of Detachable Accessory to make the platform able to replace human in special and dangerous tasks by assembling it with different specialized devices;

Develop detailed design based on series of feasibility verification experiments such as testing the performance of different distributions of the vanes in centrifuge and testing the mechanical strength of different structures of the vacuum chamber frame;

Determine the size, weight and size requirements of each part based on WBS method, establish the platform's digital mock-up with SolidWorks, finish the progress of manufacturing, processing and assembling all our own.

Interdisciplinary Modeling Program, School of Mathematics & System Engineering, Beihang University, RA, Team leader, Advisor: *Prof. Xiaobing Ma* (Nov. 2009 – Mar. 2012)

Optimization Scheme of Classroom Light Placement Project, build physical model of the relationship between placement parameters and feelings of human eyes and identify optimal parameters' value using numeric method (Matlab & C++);

Arrangement of Mining Trucks in Quarry Project, use both Genetic Algorithm and improved Greedy Algorithm to solve the problem of Chinese Postman Problem and compare the performances of the two algorithms;

Estimation of Epidemic SARS Spread Project, build the mathematical model by a series of differential equations according to the classical SIR model, estimate the parameters of the model by maximum likelihood estimate method and carry out sensitivity analysis of the model.

Postgraduate

Compliant Safe Robot Joint, Medical Robotics Laboratory, The Chinese University of Hong Kong, Ph.D. Candidate, Supervisor: *Prof. Yunhui Liu* (Sep. 2013 – May. 2015)

Mechanical design of the compliant safe robot joint;

Structure optimization by analyzing how the key parameters affect the joint's performance (torque threshold, stiffness under compliant state, etc.);

Design the torque regulation controller and the trajectory tracking controller;

Conduct the collision experiments with human to validate the performance of the joint.

Endoscope Manipulator for Sinus Surgery, Medical Robotics Laboratory, The Chinese University of Hong Kong, Ph.D. Candidate, Supervisor: *Prof. Yunhui Liu* (since Oct. 2013)

Assist with the mechanical structure optimization of the endoscope manipulator (2nd & 3rd version);

Build the control system (hardware & software) for the endoscope manipulator (3rd version).

Uterus Manipulator for Hysterectomy, Medical Robotics Laboratory, The Chinese University of Hong Kong, Ph.D. Candidate, Supervisor: *Prof. Yunhui Liu* (since Aug. 2014)

Assist with the mechanical structure optimization of the endoscope manipulator (3rd version);

Assist with system assembly (3rd version).

Laparoscopic Instruments Pose Control for Minimally Invasive Robotic Surgery, The Chinese University of Hong Kong, Ph.D. Candidate, Supervisor: *Prof. Yunhui Liu* (since Jan. 2015)

Calibration of camera extrinsic parameters using laparoscopic instrument's projection;

Image based trajectory tracking control of 4-DoF laparoscopic instruments.

Publications

Journal Articles

1. **Z. Wang**, H. M. Yip, D. Navarro-Alarcon, P. Li and Y.-H. Liu (2015). Design of a Novel Compliant Safe Robot Joint with Multiple Working States. *IEEE/ASME Trans. Mechatronics, revised and resubmitted*.
2. H. M. Yip, **Z. Wang**, D. Navarro-Alarcon, P. Li, Y.-H. Liu, T. H. Cheung, and Y. Fu (2015). Development of an Assistive Surgical Robot for Laparoscopic Hysterectomy. *IEEE/ASME Trans. Mechatronics, under review*.
3. D. Navarro-Alarcon, H. M. Yip, **Z. Wang**, Y.-H. Liu and P. Li (2015). Automatic 3D Manipulation of Soft Objects by RCM Robotic Instruments with Adaptive Deformation Model. *IEEE Trans. Robot., under review*.

Conference Proceedings

1. **Z. Wang**, D. Navarro-Alarcon, F. Zhong, H. M. Yip, Y. Lu and Y.-H. Liu (2016). Image Based Trajectory Tracking Control of 4-DoF Laparoscopic Instruments Using a Rotation Distinguishing Marker. *IEEE Int. Conf. Robotics and Automation, under review*.
2. D. Navarro-Alarcon, **Z. Wang**, H. M. Yip, Y.-H. Liu, F. Zhong and Tianxue Zhang (2016). Robust Image-based Computation of the 3D Position of Laparoscopic Instruments and its Application to Image-guided Manipulation. *IEEE Int. Conf. Robotics and Automation, under review*.
3. **Z. Wang**, P. Li, D. Navarro-Alarcon, H. M. Yip, Y.-H. Liu, W. Lin and L. Li (2015). Design and Control of a Novel Multi-state Compliant Safe Joint for Robotic Surgery. *IEEE Int. Conf. Robotics and Automation* 1023-1028.
4. H. M. Yip, **Z. Wang**, D. Navarro-Alarcon, P. Li and Y.-H. Liu (2015). A New Robotic Uterine Positioner for Laparoscopic Hysterectomy with Passive Safety Mechanisms: Design and Experiments. *IEEE/RSJ Int. Conf. Intelligent Robots and Systems* Accepted.
5. D. Navarro-Alarcon, H. M. Yip, **Z. Wang**, Y.-H. Liu, W. Lin and P. Li (2015). Gradient Descent Adaptive Methods to Automatically Position 3-DOF RCM Mechanisms with a Monocular Camera. *IEEE/RSJ Int. Conf. Intelligent Robots and Systems* Accepted.
6. W. Lin, D. Navarro-Alarcon, P. Li, **Z. Wang**, H. M. Yip and Y.-H. Liu (2015). A New Robotic Uterine Positioner for Laparoscopic Hysterectomy with Passive Safety Mechanisms: Design and Experiments. *IEEE/RSJ Int. Conf. Intelligent Robots and Systems* Accepted.
7. Y. Lu, Y.-H. Liu, **Z. Wang** and F. Zheng (2015). Lens-free and portable quantitative phase microscope using a dual-pinhole aperture. *IEEE Int. Sym. Optomechatronic Technologies* Accepted.
8. D. Navarro-Alarcon, **Z. Wang**, H. M. Yip, Y. Liu, P. Li and W. Lin (2014). A Method to Regulate the Torque of Flexible-joint Manipulators with Velocity Control Inputs. *IEEE Int. Conf. Robotics and Biomimetics* 2437-2442.
9. H. M. Yip, P. Li, D. Navarro-Alarcon, **Z. Wang** and Y.-H. Liu (2014). A new circular-guided remote center of motion mechanism for assistive surgical robots. *IEEE Int. Conf. Robotics and Biomimetics* 217-222.