Ajinkya Bhole

Motion Control Design & System Dynamics Enthusiast

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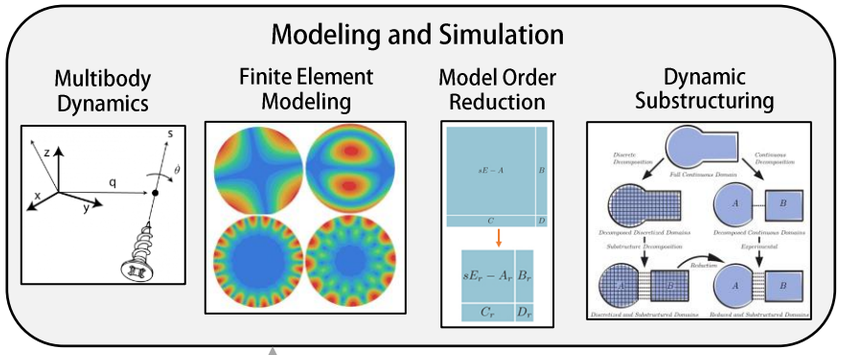

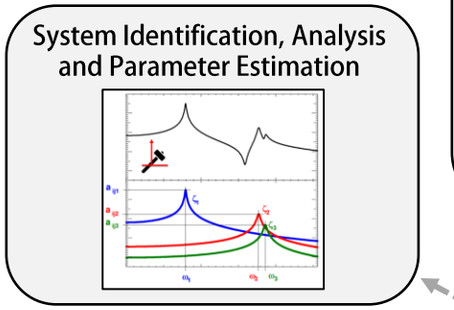

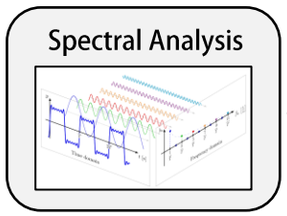

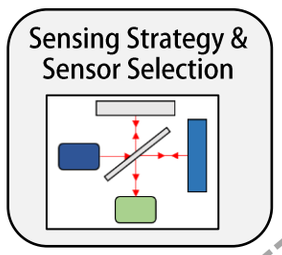

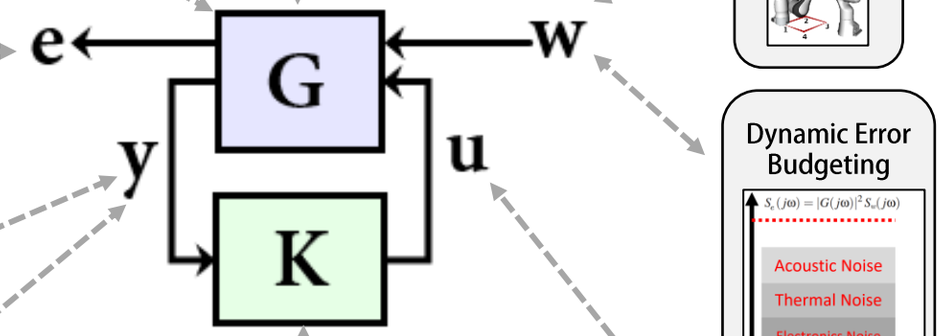

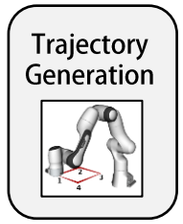

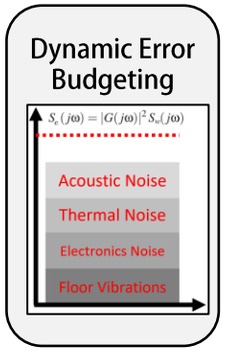

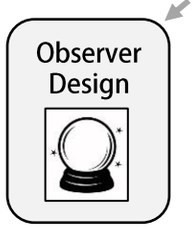

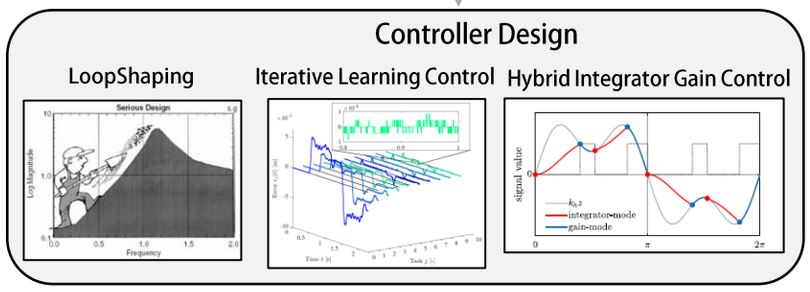

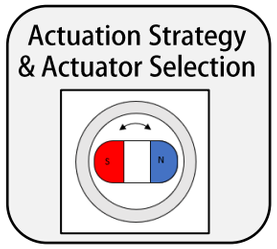

Programming & Tools

MATLAB, Ansys, Python, 20-sim, Arduino, SolidWorks, PyCharm, Julia, ROS

Courses and Trainings

- Dynamics and Modeling (High Tech Institute 2022)
- Learning and Adaptive Control (DISC 2022)
- Mathematical Modeling of Systems (DISC 2023)
- Nonlinear Control Systems (DISC 2023)
- Nonlinear Control for Performance (DISC 2023)
- Design Methods for Control Systems (DISC 2023)
- HEEDS: Design Exploration and Optimization (Siemens 2023)
- Design Principles for Precision Engineering (High Tech Institute 2024)

Education

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2016 - 2018	**MSc. in Systems and Control** University of Twente, The Netherlands (Courses)	GPA: 8.2/10
2018	**MSc. Honours in Design** University of Twente, The Netherlands	
2012 - 2016	**B.E. Hons. in Mechanical Engineering** BITS Pilani – Pilani Campus, India	GPA: 7.9/10

Publications

- Online Estimation of Impedance Parameters for a Variable Impedance Controlled Robotic Manipulator.
  A. Bhole, F. Ficuciello, A. Mashayekhi, S. Strano, M. Terzo, L. Villani, B. Sciciliano (IFIT 2018) (Link)
- Control of a Variable Stiffness Joint for Catching a Moving Object.
  A. Bhole, J. Kumle, S.S. Grothuis, R. Carloni (IROS 2018) (Link)
- Design of a Robust Stair Climbing Compliant Modular Robot to Tackle Overhangs on Stairs
  A. Bhole, S.H. Turlapati, V.S. Rajashekhar, J. Dixit, S.V. Shah, K.M. Krishna (Robotica 2018) (Link)

Thesis

- Masters Thesis: Towards KriCatch, A Slip Catching Practice System for the game of Cricket
  Advisors: Douwe Dresscher, Stefano Stramigioli (RAM Lab, University of Twente, The Netherlands)
- Bachelors Thesis: Design of a Robust Stair Climbing Compliant Modular Robot to Tackle Overhangs on Stairs
  Advisors: Suril V. Shah, K. Madhav Krishna (Robotics Research Center, IIIT Hyderabad, India)

Work

Feb 2019 – Present
System Engineer within Drive and Controls Group (Projects)
Sioux Technologies B.V. Eindhoven, The Netherlands
- Facilitating development of multidisciplinary systems through Systems Engineering Process.

Systems Thinking | Concept Design Studies | Modeling and Simulation | System Budgeting | Control System Design and Implementation | Testing, Verification and Validation

July 2017 – Dec 2017
Research Intern
PRISMA Lab University of Naples Federico II, Naples, Italy
With Fanny Ficuciello, Luigi Villani and Bruno Sciciliano
- Realized Variable Impedance Control for a robotic manipulator (KUKA LWR) and ensured task stability using *energy-tanks*. (Link)

Energy Tanks | Passivity-based control | Variable Impedance Control

Aug 2016 – Dec 2016
Research Assistant
RAM Lab University of Twente, The Netherlands
With Raffaella Carloni
- Devised a control strategy, inspired by the natural mechanism of adjusting hand impedance to catch objects, onto an arm actuated by variable stiffness actuator. (Link)

Variable Stiffness Actuators | Optimal Control

References

Fanny Ficuciello
Associate Professor
Robotics and Control Group
University of Naples Federico II
fanny.ficuciello@unina.it

Douwe Dresscher
Assistant Professor
Robotics and Mechatronics Group
University of Twente
d.dresscher@utwente.nl

Raffaella Carloni
Associate Professor
Bernoulli Institute for Mathematics, Computer Science and AI
University of Groningen
r.carloni@rug.nl

Harm Clements
System Designer
Drive and Control Group
Sioux Technologies B.V.
harm.clements@sioux.eu

Projects at Sioux Technologies as a Systems Engineer

2019 - 2020

Dreh Schiebe Kalibration (Carl Zeiss SMT): A module, part of the 3FM machine of Zeiss, used to calibrate spherical waves

Responsibilities

- Mechatronics Design Engineer
- Test & Verification Engineer

Tasks

- Modeling and Calculations for viscoelastic Tuned Mass Dampers
- Mechatronics Integration (System Identification and Controller Tuning)
- Performed Testing and Verification of module performance specifications

Takeaways

- Lumped-Element Modeling of Viscoelastic dampers
- Experimental Modal Analysis
- Field Oriented Control of Brushless Motors
- Embedded Programming and Unit Testing

2019 - Ongoing

SAXCS Toolchain (Internal Project): Extension Development of Smart And fleXible Control Solutions, a motion control platform used within Sioux

Responsibilities

- Control Systems Specialist

Tasks

- Developed comprehensive understanding of the motion control platform
- Authored beginner's manual and executive summary showcasing platform capabilities
- Added Features for:
  - System Identification: Multi-Sine Frequency Response Function generation (Contributor)
  - Advanced Feedforward Techniques: Iterative Learning Control (Contributor)
  - Advanced Feedback Control Techniques: Hybrid Integrator Gain Control (Lead)

Takeaways

- Technical Documentation
- Customer Engagement
- Feature Development
- Control Design (Simulink)
- Advanced System Identification and Controller Designs

2020 - 2023

Y-Arm FuMo (ASML): A pre-prototype of the submodule of the Retical Masking Module of EXE-5000 Lithography machine of ASML

Responsibilities

- Mechatronics Design Engineer
- Test and Verification Engineer
- Team Lead

Tasks

- Performed Structural Dynamics Design Studies and Analysis
  - Balance Mass Design, Metrology Frame and Suspension Selection
- Performed Mechatronics Integration
  - Selection of: Amplifiers, Sensors and Interfacing
  - Supervisory Control Design and Implementation
  - MIMO Control Design, Implementation and Tuning
- Performed Testing and Verification of module performance specifications
- Led and facilitated testing activities for various types of investigation studies

Takeaways

- Reaction Force Compensation Methods
- Dynamic Error Budgeting
- MIMO Control
- EtherCAT Technology and Interfacing
- Logic Driven System Modeling (Stateflow)
- Systems Engineering Process

2022 - Ongoing

ReMa (ASML): Design Validation and Improvements of the Retical Masking Module of EXE-5000 Lithography machine of ASML

Responsibilities

- Mechatronics Design Engineer
- Test and Verification Engineer
- Dynamics Analyst

Tasks

- Provided Design Specification for Validation Environment (from Dynamics POV)
- Authored test specifications for model validation
- Prepared Finite Element Models for Experimental Modal Analysis
- Performing Testing and Verification of module performance specifications
- Generation of Models using the method of Dynamic Substructuring
- Validating Models by comparing to experimental data
- Sensitivity studies using Surrogate Models
- Mitigation of Dynamics related issues

Takeaways

- Modal Analysis (Ansys Workbench)
- Dynamic Substructuring
- Model Order Reduction
- Surrogate Modeling
- Setpoint Shaping
- Active Vibration Control

2024 - Ongoing

Adapto X (Vanderlande): A shuttle-based automated storage and retrieval system

Responsibilities

- Mechatronics Systems Engineer

Tasks

- Engaging with customer and performing requirements analysis
- Performing feasibility studies
- Translate customer requirements into concrete documentation

Takeaways

- Communication Skills (active listening and ideas articulation)
- Systems Engineering Process