

Research project / Student thesis

Multi-Rate Information Fusion for Heavy Object Manipulation

Motivation

At the Chair of Automatic Control, a dual-arm robotic system is employed for heavy load manipulation. To ensure efficient and reliable operation, various sensors are integrated, including joint position and torque sensors, as well as camera-based motion capture systems. Each sensor type presents unique challenges, such as signal offsets, noise, and varying data frequencies. Furthermore, message drops can occur, complicating data processing and fusion [1]. Addressing these challenges is essential for precise and reliable system control.



Task description

The project begins with a comprehensive literature review to identify suitable sensor fusion algorithms capable of handling signal variances and providing accurate state estimates for both the manipulated load and the robotic system. The identified methods should then be evaluated and validated against experimental data. The final objective is to deliver a well-founded recommendation for integrating the optimal approach into the control system.

Requirements

- Proficiency in Python and/or C++ and experience with ROS2
- Completion of the Robotics 1 course
- Fundamental knowledge of digital filtering methods and sensor fusion techniques

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References

[1] Fatehi, Alireza, and Biao Huang. "Kalman filtering approach to multi-rate information fusion in the presence of irregular sampling rate and variable measurement delay." *Journal of Process Control* 53 (2017): 15-25.