

Advanced Control Technology Development Project for Precision Module Automation

Research Focus

- Accurate speed estimation under full-load operating conditions
- Fast current loop design for high bandwidth requirements
- Self-tuning strategies for parameters in Field Oriented Control (FOC)
- Accurate online identification of parameters in the PMSM system

Contact

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Short Description

This project focuses on the advanced control framework design for PMSM-based automation equipment. It aims to construct a fast, reliable, and stable control framework, further improving the system's bandwidth, speed estimation accuracy, and harmonic distortion performance. Additionally, the project will conduct research on automatic self-tuning of controller parameters and self-identification of system parameters, achieving a more general and precise strategy for servo motor drives.

Pictures

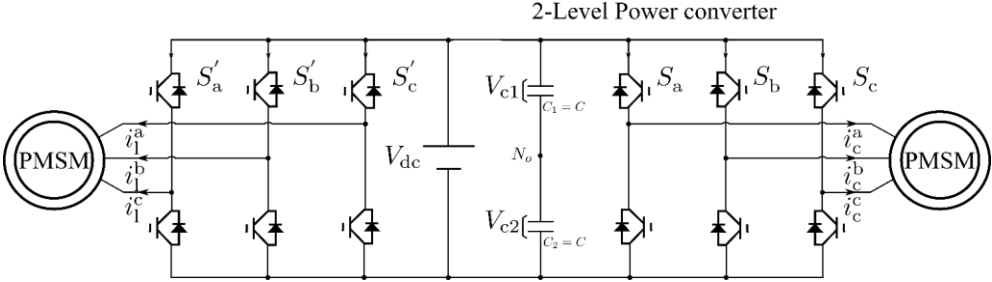


Figure 1. Circuit of Motor-to-Motor Drive System

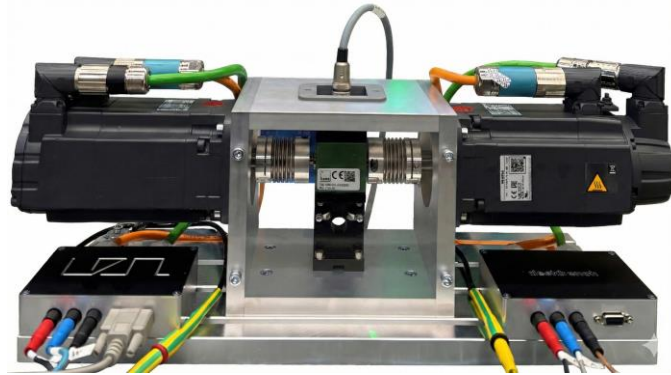


Figure 2. Testbench of Motor-to-Motor Drive System.

Publications

- W. Tian, Q. Yang, X. Gao, P. Karamanakos, X. Yin, R. Kennel and M. Heldwein, "Fast Indirect Model Predictive Control for Variable Speed Drives," in *IEEE Transactions on Power Electronics*, vol. 38, no. 11, pp. 14475-14491, Nov. 2023, DOI: [10.1109/TPEL.2023.3307773](https://doi.org/10.1109/TPEL.2023.3307773).
- X. Gao, Y. Pang, W. Tian, D. Kong, J. Rodriguez and R. Kennel, "Model-Free Predictive Current Control of PMSM Drives Using Recursive Least Squares Algorithm," *2023 IEEE International Conference on Predictive Control of Electrical Drives and Power Electronics (PRECEDE)*, Wuhan, China, 2023, pp. 1-6, DOI: [10.1109/PRECEDE57319.2023.10174599](https://doi.org/10.1109/PRECEDE57319.2023.10174599).
- Q. Duan, W. Tian, Q. Yang, X. Gao, Y. Mao, P. Karamanakos, R. Kennel and M. Heldwein, "Computationally Efficient Overmodulation Methods for Synchronous Motor Drive Systems," in *IEEE Transactions on Industrial Informatics*, vol. 19, no. 4, pp. 6182-6195, April 2023, DOI: [10.1109/TII.2022.3207773](https://doi.org/10.1109/TII.2022.3207773).