The direct strain feedback with PID control approach for a flexible manipulator: Experimental results

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ABSTRACT

Flexible manipulator (FM) is a robotic arm that can accomplish different tasks and the arm is a lightweight type, which means at least one dimension of their cross section is relatively small compared to their length. This project presents the development of direct strain feedback (DSFB) with PID controller for vibration control of a FM system. Strain gauge is the main sensor used as a strain measurement for giving a feedback to the system. The strain measurement also has been used as a displacement sensor at the endpoint of the link. The displacement was used to observe the performance of the system. The performances of the controllers are assessed in terms of the input tracking capability (desired position) and vibration reduction as compared to original system. Finally, the DSFB with PID has been implemented to achieve the desired performance.

KEYWORDS:

DSFB; Flexible Manipulator; MATLAB/Simulink; PID controller; PID Tuning

REFERENCES

- R.J. Theodore, A. Ghosal. Comparison of the assumed modes and finite element models for flexible multi-link manipulators. The International Journal of Robotics Research 14 (2). 1995. 91-111.
- 2. Zhang Tiemin, Liu Youwu; Yan Shaoze; Zhang Qing; Zhang Haigen;. Comparative Study on the Acceleration Feedback and the Strain Feedback of a Flexible Manipulator. IEEE International Conference on Systems, Man and Cybernatics. 14-17 Oct 1996.
- 3. R. P. Sutton, G. D. Halikias, A. R. Plummer, and D. A. Wilson. "Robust control of a lightweight flexible manipulator under the influence of gravity. Proceedings of the 1997 IEEE International Conference on Control Applications, 1997. 300-305.
- 4. Gulay Oke and Yorgo Istefarwpulos. Gradient-Descent Based Trajectory Planning for Regulation of a Two-Link Flexible Robotic Arm. IEEHASME International Conference on Advanced Intelligent Mechatronics Proceedings 8-12 July 2001 9 Como, Italy. 2001.
- 5. Mohamed,Z and Tokhi, M.O. Vibration control of a single link flexible manipulator using command shaping techniques. Proceeding of IMechE-I: Journal of System and Control Engineering. 2002. Vol. 216(2): 191-210. (Pubitemid 34474072)