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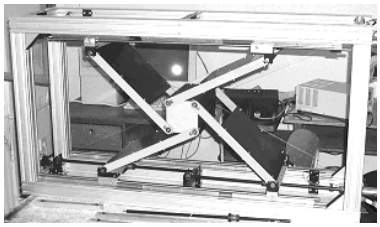
PREDICTIVE CONTROL ALGORITHMS APPLIED to PARALLEL ROBOTS

Nowadays, the future development of industrial robots – machine tools – requires change and improvement of their control. It means replacement of traditional control (e.g. NC systems, PID/PSD structures) by approaches that fully utilize available knowledge of properties of the machines. Traditional approaches provide control of the tool drives as separate units only, but not solve the control from view of the whole machine system. On the other hand, the modern approaches, taking into account tool dynamics and kinematics, design the control from global point of view – from view of the whole system. This contribution will introduce various utilization and possibilities (not only control tasks) of the model-based predictive control. The predictive control represents one of up-to-date way that can be applied in new developing industrial robots.



Example of parallel robot structure (Sliding Star).

The basic control tasks of the robots arise partly from their structure partly from requirements of the users (expected behavior). In a branch of parallel machines especially over-actuated, the issue is to provide optimal cooperation of all drives interrelated via movable platform (gripper, chuck). The predictive control uses mechanical model (model described robot kinematics and dynamics) to design of control actions corresponding with actual requirements to robot movement. It provides optimizing of energy demands. Among others, this contribution will concern with trajectory planning, backlash elimination and removing of positional steady-state errors.

The literature

1. **Stejskal, V., Valášek, M.** Kinematics and Dynamic of Machinery // Marcel Decker, New York, 1996.
2. **Belda, K., Böhm, J., Valášek, M.** Digital Control of Over-Actuated Parallel Robots // Proc. of the Int. Conf. on Methods and Models in Automation and Robotics // MMAR 2004, Miedzyzdroje, Poland, pp. 819-824.
3. **Belda, K., Böhm, J., Valášek, M.** Study of predictive control algorithms for parallel robot structures. // Proceedings of the 6th Int. Conf. Process Control 2004, Pardubice, Czech Republic, pp. 1-9.