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A tracking controller design for a manipulator after its actuator failure

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The paper topic relates to modeling and control of constrained mechanical systems, where the constraints origin from a system underactuation. The system represented by a 3 degree of freedom manipulator is underactuated when the number of control inputs is less than the number of degrees of freedom. This may happen after a failure of one or more of the actuators. The problem is quite significant from the practical point of view, since an actuator failure may cause damages of a system itself or in its work environment. An active research goes on in this control area and the aim of the presented research is to develop some control method for a manipulator when one of the actuators breaks down during its operation. The control goal is to enable the end effector of a broken manipulator completing tracking a predefined task and get back to its rest position. The contribution of the presented research relies upon the formulation of the control goal, which comparing to the results reported in the literature, requires a completing of the end-effector task as precisely as it can but not only stop and return to its rest position. Specifically, the task is a predefined trajectory and the 3 degree of freedom manipulator can work in a horizontal and vertical planes. Two model-based control methods are proposed for cases of the horizontal and vertical manipulator operations after its actuator failure. Numerical studies illustrate the control method application results.

Biography

Elzbieta Jarzebowska is currently a professor at the Institute of Aeronautics and Applied Mechanics at the Power and Aeronautical Engineering Department, Warsaw University of Technology, Warsaw, Poland. She received the BS, MS, PhD, and DSc degrees in mechanical engineering, control and mechanics of constrained systems, from the Warsaw University of Technology. Her fields of research expertise and teaching include dynamics modeling and analysis of multibody systems, nonlinear control of multibody systems including nonholonomic, under actuated, UAV, and mobile robotic systems, and geometric control theory. She was involved in research projects for Automotive Research Centre and Engineering Research Centre for Reconfigurable Machining Systems at the University of Michigan, Ann Arbor, MI. Also, she gained valuable experience when worked for Ford Motor Company Research Laboratories, Dearborn, MI. She is the author and coauthor of five handbooks and a monograph in mechanics and control, and more than 100 publications. She is a member of ASME, IEEE, GAMM, IFToMM Technical Committee of Mechatronics, and International Society for Advanced Research - Italy based society and a scientific publisher.

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