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SUPERVISORY SWITCHING STRATEGY IN MOTION/FORCE CONTROL OF ROBOTIC MANIPULATION

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Abstract. A switching controller for a class of robotic manipulators with grasping capabilities is presented. The aim is to control the motion of the grasped object along a desired trajectory while complying with contact force constraints. The algorithm successfully performs its control task by switching between several controllers induced by different operating conditions of the manipulator–object system. Simulation results are presented to show the efficacy of the proposed method.

Keywords. Robotic manipulators, switching control, position/force control.

AMS (MOS) subject classification: 93C10 (Nonlinear systems), 93B18 (Linearization), 93C40 (Adaptive control), 93C85 (robots).

1 Introduction

This paper deals with the position/force control in co–operative robotic manipulation of an object. Often these robotic systems are required to track a desired object trajectory while fulfilling a set of constraints on the contact forces applied to the object, cf. [13].

In the robotics literature the general problem of force/motion control is known as "hybrid control". For a broad overview on this topics the reader is referred to [19] and the references therein. The analysis of the dynamics and the control of manipulation systems becomes more complex when it is not possible to control contact forces in all directions. This usually occurs when the number of DoF's of the robotic device is smaller than the dimension of the contact force space. In [16] such a case has been defined as "defective grasp". This is the norm in industrial applications where kinematic defectivity is a common factor for almost all grippers. The problem of position/force control for such a wide class of robotic system is the subject of this paper. The dynamics of such a class of systems has been thoroughly described in [16]. The main result of such work consisted