

# Optimal force distribution and dynamic control for multiple manipulators grasping an object

A. Khadraoui (a), C. Mahfoudi (b)

(a) U. Larbi Ben M'Hidi , Institute of Mechanics, Ain Beida, Algeria

Email: omar.khadraoui@gmail.com

(b) U. Larbi Ben M'Hidi , Institute of Mechanics, Ain Beida, Algeria

Email: c-mahfoudi- [dz@yahoo.fr](mailto:dz@yahoo.fr)

**ABSTRACT.** Cooperative systems are generally understood as several coordinated robots simultaneously performing a common given task such as changing the space position of an object, grasping an object, gripping, lifting, lowering, releasing, withdrawing. The purpose of controlling a cooperative system consists of controlling contact forces between the environment and the object under consideration. Several approaches in the literature have been proposed to address the robot coordination problem.

This paper deals with multi-robots grasping problem. We present an optimal force distribution strategy for holding and manipulating objects by multiples manipulators. The force distribution issue is formulated in terms of a nonlinear programming problem under equality and inequality constraints. In particular, the friction constraints are transformed from non linear inequalities into a combination of linear equalities and linear inequalities. As a result, the original nonlinear constrained programming problem is then transformed into a quadratic optimization problem. The dynamical model of multi-robot cooperation has been used for determining force control distribution through proportional derivative (PD) controller. Simulation has been performed and some results are presented and discussed.

**Keywords :** dynamic modeling and control , friction constraints , grasping , Multi-robots cooperation , optimal force distribution , quadratic programming.