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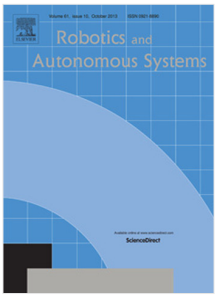

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George S. Kanakis, Fotios Dimeas, George A. Rovithakis, Zoe Doulgeri

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ACCEPTED MANUSCRIPT

Prescribed Contact Establishment of a Robot with a Planar Surface under Position and Stiffness Uncertainties

George S. Kanakis[a,b], Fotios Dimeas[a,b], George A. Rovithakis[a,b,*], Zoe Doulgeri[a,b]

[a] *Center for Research and Technology Hellas (CERTH), 57001 Thessaloniki, Greece*
[b] *Aristotle University of Thessaloniki, Dept. of Electrical and Computer Engineering, 54124, Thessaloniki, Greece*

Abstract

Robot arms that operate in unstructured and dynamic environments often need to establish contact with a planar surface, while avoiding the appearance of excessive contact forces. This is a difficult task given that exact knowledge of the robot or the environment model parameters is not available. In this paper a novel, continuous in time, controller is designed, capable of establishing and maintaining contact of the robot with a planar surface of unknown stiffness and position. The proposed control scheme guarantees that the resulted contact force, normal to the surface, is *a priori* bounded by user-defined bounds, while imposing prescribed transient and steady-state performance attributes on the post-contact position and orientation error response. All remaining closed-loop signals are also kept bounded. The controller is validated via experimental studies performed on a KUKA LWR 4+ robot. Additionally, a comparison is conducted with a relative approach from the literature. The results verify the theoretical findings.

1. Introduction

The establishment of contact between the robot's end-effector and the environment is a vital part of tasks that involve assembly, precise handling or surface processing (e.g., polishing). The main issue in contact establishment concerns the contact force magnitude that may take prohibiting values at the instant of contact, particularly at high mechanical stiffness of the robot or the environment. This force overshoot is attributed to delays in contact detecting mechanisms, uncertainties regarding the robot/contact model, and possible

*Corresponding author
Email addresses: gkanakis@iti.gr (George S. Kanakis), dimeasf@ee.auth.gr (Fotios Dimeas), robi@{iti, eng.auth}.gr (George A. Rovithakis), doulgeri@{iti, eng.auth}.gr (Zoe Doulgeri)

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