

# Robot Positioning of Flexible-link Manipulator using Vision

Halûk Küçük<sup>1</sup>, Gordon Parker<sup>2</sup> and Eric T. Baumgartner<sup>3</sup>

<sup>1</sup> *Nigde University, Aksaray Faculty of Engineering, Aksaray (TURKEY). E-mail: [hkucuk7@hotmail.com](mailto:hkucuk7@hotmail.com)*

<sup>2</sup> *Michigan Technological University (USA)*

<sup>3</sup> *Jet Propulsion Laboratory, California Institute of Technology (USA).*

## Abstract

Vision-aided flexible link robot positioning using the Camera Space Manipulation (CSM) method is developed. The primary motivation for this work is to use an autonomous vision-aided robotic system to pick-up and accurately move a flexible object that it encounters. The work consists of analytical and experimental investigation of the performance of CSM for a kinematic model of the PUMA manipulator with a flexible structure at the wrist which accounts for the gravitation. Trade-offs between camera view parameters and axial deflection model parameters were investigated. View parameter re-estimation and maneuvering resulted in a very accurate placement of the end-effector at the target.

**Key Words:** Machine vision; Camera space manipulation; Robot; Vision system.