MECHANICAL DESIGN AND MOTION PLANING OF A MODULAR RECONFIGURABLE ROBOT

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This paper studies kinematics and dynamics of a reconfigurable modular robot consisting of ten modules. Motion planning for 3 different configurations; snake-like, inch-worm like and loop like robot are studied in detail. Actuating motors selection and mechanical design are done based on the simulation results. Designed trajectories are implemented in real open-loop control experiments for all configurations. The experiments show very satisfying results.

1. Introduction

A modular reconfigurable robot is constructed from a large number of homogeneous modules; each module is capable of being mechanically (and usually electrically) connected to other modules which are capable of being reconfigured to form arbitrary chain-based topology. This reconfiguration requires the detaching of modules from one point in the system and reattaching it to another [1]. Some modular reconfigurable systems are manually reconfigurable and others are self-reconfigurable. Modular robots can change their shape to get the job done.

A modular reconfigurable system holds out three promises: versatility, robustness and low cost [2] [3]. Since the properties of a robot change with its form then a robot that can change its form is extremely versatile [1]. Due to high redundancy and modularity the robot is robust to mechanical failure and easy to repair by replacing damaged module with new one. Being same in type, the modules can be mass produced and as economies of scale come into play, the cost of each one can be reduced.