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Design and Control of Variable Length Hyper Redundant Robot

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Abstract

This paper puts forward a design concept of Variable length Hyper-redundant robot, consisting of eight links and their encloser system. Each of the rigid links is connected via actuated revolute joints in a chain. The robot will operate on the principle that one by one link will be coming out of the housing and moving towards the desired position. The robot can be a practical and cost saving approach in complex and unstructured area. In one particular operation, the variable length Hyper-redundant robot can provide shorter trail and shorter time as well compared to fixed number of links. The basic robotics analyses, dynamics simulation and experiment are also shown. The prototype developed is used as a proof of the concept.

Keywords: *Redundant Robot; Robot Manipulator;Viriable Length HRR.*

Nomenclature

2-D	Two Dimensions
3-D	Three Dimensions
ORM	Oriented Redundant Manipulator
HRR	Hyper Redundant Robot
DOF	Degree of Freedom
FOP	Fourth order polynomial
IO	Input Output
DC	Direct Current
VHRR	Variable length Hyper Redundant Robot
FHRR	Fixed length Hyper Redundant Robot
p	Density (lb/in.^{3})
W	Weight (lb)
R	Radius (in)
g	Gravitational constant (386 in/sec^2)
Jl	Load inertia (lb-in-sec^2)
Jls	Worm gear / lead screw inertia (lb-in-sec^2)

1. Introduction

The existence of hyper redundant robot (HRR) manipulator gathers many attentions due to their various applications in industries such as robot surgeon in surgery, rescue robot for mapping disaster scenario, multi tasking robot for autonomous nuclear plant operation, space exploration and maintenance and so on. Thus, the study of planar robot (2-D) as well as

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