

Analysis of modelling methods for soft robots

Abstract

Masterthesis at IRS-VSA.

The goal of this Thesis is the analysis of common modelling methods of Continuum Manipulators

Start: ASAP

Tags: Robotics, Soft Robotics, Modelling



Supervisor:

Linus Witucki, M. Sc.

IRS-VSA, Raum 212

Tel.: 0721/608-42628

linus.witucki@kit.edu

Motivation

The context of Industry 4.0 is making human-robot collaboration increasingly important. It promises to combine the repeatability and precision of robots with the flexibility and decision-making skills of humans. Therefore, robots that are small, light, and have torque sensors are being developed to make them safe for close physical coupling with humans. However, safety is only guaranteed through sensors and software. In a fail-state, the robot can still harm the human. As a result, a completely new kind of robot emerged, the soft robot. Mostly, they consist of soft materials like cloth or silicon and are actuated pneumatically instead of motors. Such robots are inherently safe for direct human-robot coupling. An example of a soft robot can be seen in Figure 1. To get the soft robots out of research and into industrial use, tools for implementing them in automation systems are required. One important aspect is the machine and human-readable description of such a robot.

Goal

The goal of this thesis is to establish a structured overview of attributes and parameters necessary for mathematically modelling a soft robot. This is quite a challenging due to the vast amounts of different methods. Important is to have the smallest set of parameters, that can be used for as many modelling methods possible. The different methods include the Cosserat model for the exact representation, as well as discretization methods like the Piece-Wise Constant Curvature (PCC), or Piece-Wise Variable Curvature (PVC).

Helpful prior knowledge

The subsequent prior knowledge is advantageous for the completion of the final thesis:

- Robotics
- Modelling theory
- Control theory
- Information modelling

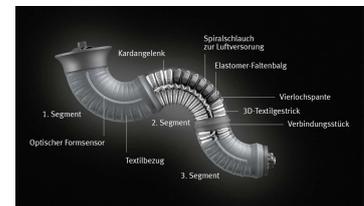


Figure 1: Soft robot @Festo

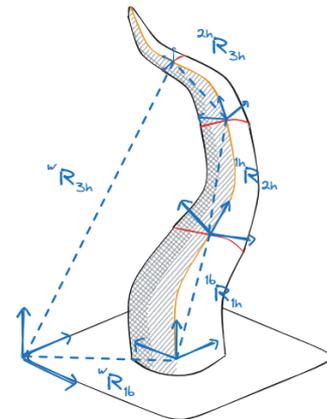


Figure 2: Soft Robot scetch