



## Master's Thesis

Studentens navn: Atussa Koushan  
Fag: Engineering Cybernetics  
Tittel (norsk): Hybrid hindringsbasert fremdrift (HOAL) av slangeroboter  
Tittel (English): Hybrid Obstacle Aided Locomotion (HOAL) in Snake Robots  
Description:

A number of different principles for snake robot locomotion have been proposed and tested, many of which are based on heuristic rules and stiff position controlled joints. A more physics-based and compliant method is being developed which is based on the formalism of *hybrid position/force control* (HPFC).

In this assignment you will study the differences between manipulator control and the free-ranging snake robot locomotion problem in the context of so-called *Dynamic HPFC* (DHPFC), adapt the method to the new problem as necessary, and assess the results in idealized scenarios.

1. Give a brief overview of the most important strategies for terrestrial snake robot locomotion, and discuss the prospective properties of HPFC in the context of your findings.
2. Adapt the method of *Dynamic Hybrid Position/Force Control*, introduced by Yoshikawa et al. in 1987, to the snake robot locomotion problem, and give a thorough description of the differences and similarities of the snake robot case vs. the traditional manipulator case. Pay special attention to the roles played by the so-called *force* and *position spaces*, and how these can be utilized and further decomposed to illuminate necessary and sufficient conditions for propulsion.
3. Select a set of scenarios and a suitable control structure and simulate these on a suitable platform. The scenarios should be chosen to illustrate and evaluate the central aspects of the method.

Veileder(e): Øyvind Stavdahl, Institutt for teknisk kybernetikk

Trondheim, 13.01.2020

Øyvind Stavdahl  
Faglærer