Chair of Computational Modeling and Simulation
TUM School of Engineering and Design
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Digital Twin of a Walking Articulated Robot

Project Characteristics

Modeling:
Mathematics:
Programming:
Science:

Task

In this project a digital twin for a *Walking Articulated Robot* will be created, simulated, and deployed using MATLAB® [1], Simulink® [2], and Simscape™ [3]. The robotic system should be able to mode along even and uneven terrain.

To achieve that, both an *Abstract* and *a Refined Design* may be employed, see the following figures:

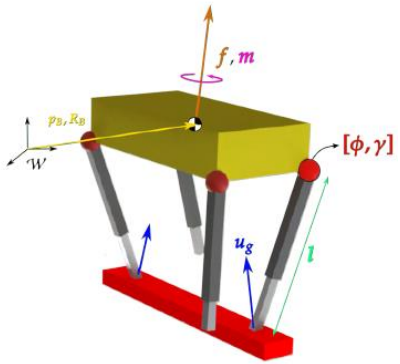

Figure Abstract design of the Husky Robot [4]

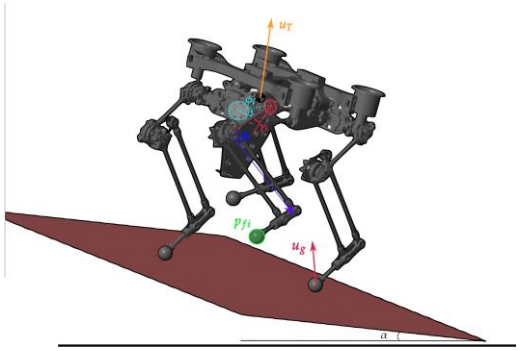

Figure Refined design of the Husky Robot in Simscape™ [3]

The tasks may include (but not restricted to) the following ones:

- Development of an *Abstract Design* of the robot using simple Simscape™ Multibody [5] blocks
- Controller design for the actuation of the joints of the Simscape-based ROM to move along simple gaits
- Set-up of a CAD and multibody model of the robot in SolidWorks™ [6] or similar
- Develop a *Refined Design* of the robot by importing the multibody model in Simscape using *Simscape™ Multibody™ Link*
- Validation testing of the refined robot design in Simscape using simple gaits
- Controller design of the refined robot design for more complex gaits also possibly using *Model-Predictive Control* (MPC) [7]

Figure Husky Carbon Platform developed at the Northeastern University in Boston, Massachusetts [4]

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References

[1] MATLAB® https://www.mathworks.com/products/matlab.html

[2] Simulink® https://www.mathworks.com/products/simulink.html

[3] Simscape™ https://www.mathworks.com/products/simscape.html

[4] Krishnamurthy, K. V. (2023). Towards dynamic narrow path walking on NU's Husky. Master's Thesis, Department of Mechanical and Industrial Engineering, Northeastern University, Boston, Massachusetts.

[5] Simscape Multibody™ https://www.mathworks.com/products/simscape-multibody.html

[6] SolidWorks® https://www.solidworks.com/

[7] What is Model Predictive Control? https://www.mathworks.com/help/mpc/gs/what-is-mpc.html, MathWorks Inc.