Chair of Computational Modeling and Simulation
TUM School of Engineering and Design
Technical University of Munich

Project Characteristics
Modeling:
Mathematics:
Programming:
Science:
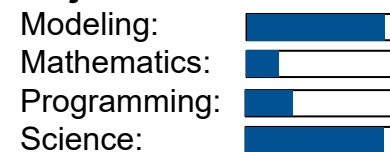
Concept Design of a Wheeled Quadruped Robot

Task: Use simulation to perform concept design

- Brainstorm product requirements, including navigation of even and uneven terrain
- Model and simulate system using MATLAB® [1], Simulink® [2], and Simscape™ [3]

The team can develop the entire model or start with a provided model of a walking quadruped robot.

Example System

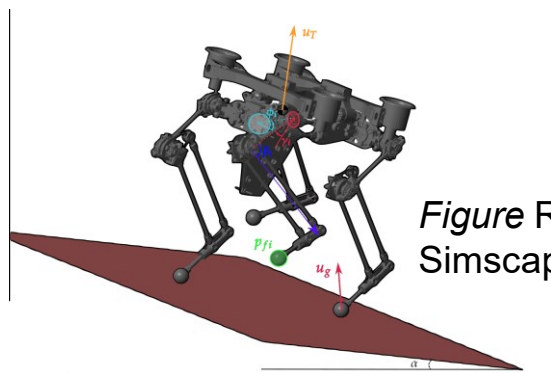https://www.unitree.com/go2-w

Figure Refined design of the *Husky Robot* in Simscape™ [4]
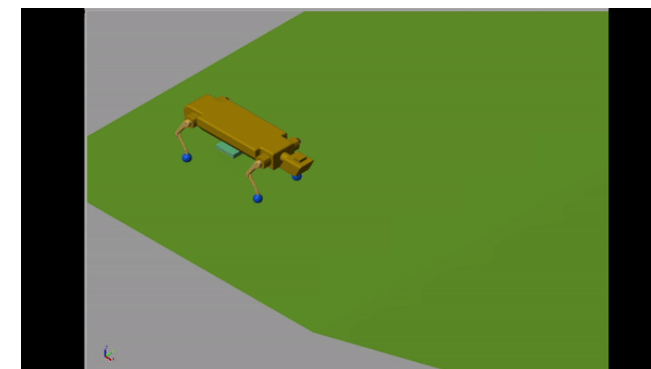
Figure Provided *Walking Articulated Robot in Simscape™*

Chair of Computational Modeling and Simulation
TUM School of Engineering and Design
Technical University of Munich

TUM

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

- Create *Abstract Design* of the *Robot* using parameterized solids from Simscape™ Multibody [5]

- Design controlled actuation system with wheels to perform basic maneuvers

- Set-up of a CAD and multibody model of the robot in SolidWorks™ [6] or similar

- Implement locomotion strategies to navigate over obstacles possibly using *Model-Predictive Control* (MPC) [7]

- Validation testing of the refined *Wheeled Quadruped Robot* design in Simscape on more complex pathways

Supervisors

- Andreas Apostolatos, Senior Application Engineer in Education, Academia Team, The MathWorks, Inc., aapostol@mathworks.com
- Jan Janse van Rensburg, Senior Product Specialist for Simscape Multibody, Application Engineering, The MathWorks, Inc., jjansev@mathworks.com
- Steve Miller, Simscape Product Manager, Product Marketing, The MathWorks, Inc., smiller@mathworks.com

Chair of Computational Modeling and Simulation
TUM School of Engineering and Design
Technical University of Munich

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.