

# Optimization Tools for Soft and Rigid Robots



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# Optimization Tools for Soft and Rigid Robots

## Research Topic

- Artificial Intelligence
- Human-Machine Interaction
- Evolutionary Computation
- Robotics
- Motion Planning
- Design

# Optimization Tools for Soft and Rigid Robots

## Research Goals

- Optimize the design of an underactuated hand exoskeleton for post-stroke rehabilitation such that it maximizes the rendered torque and it balances it on the patient's finger
- Optimize the design of soft-growing robot to perform specific tasks
- Motion planners for soft-growing robots while performing manipulation tasks
- Develop innovative evolutionary algorithms:
  - For multi-objective optimization
  - For multi-modal optimization

# How MATLAB and Simulink were used in your research

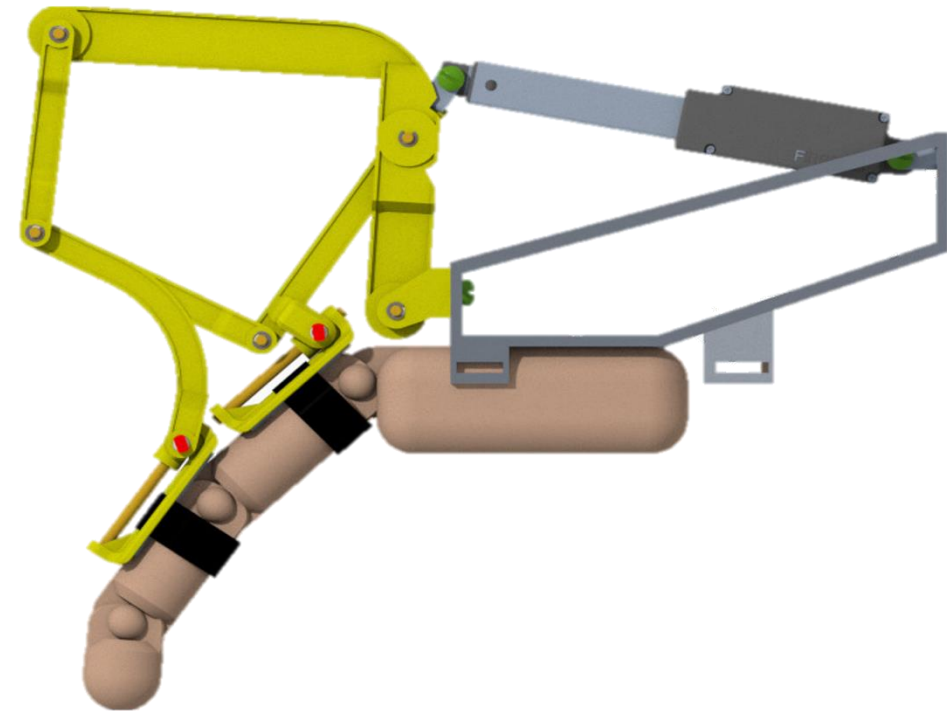
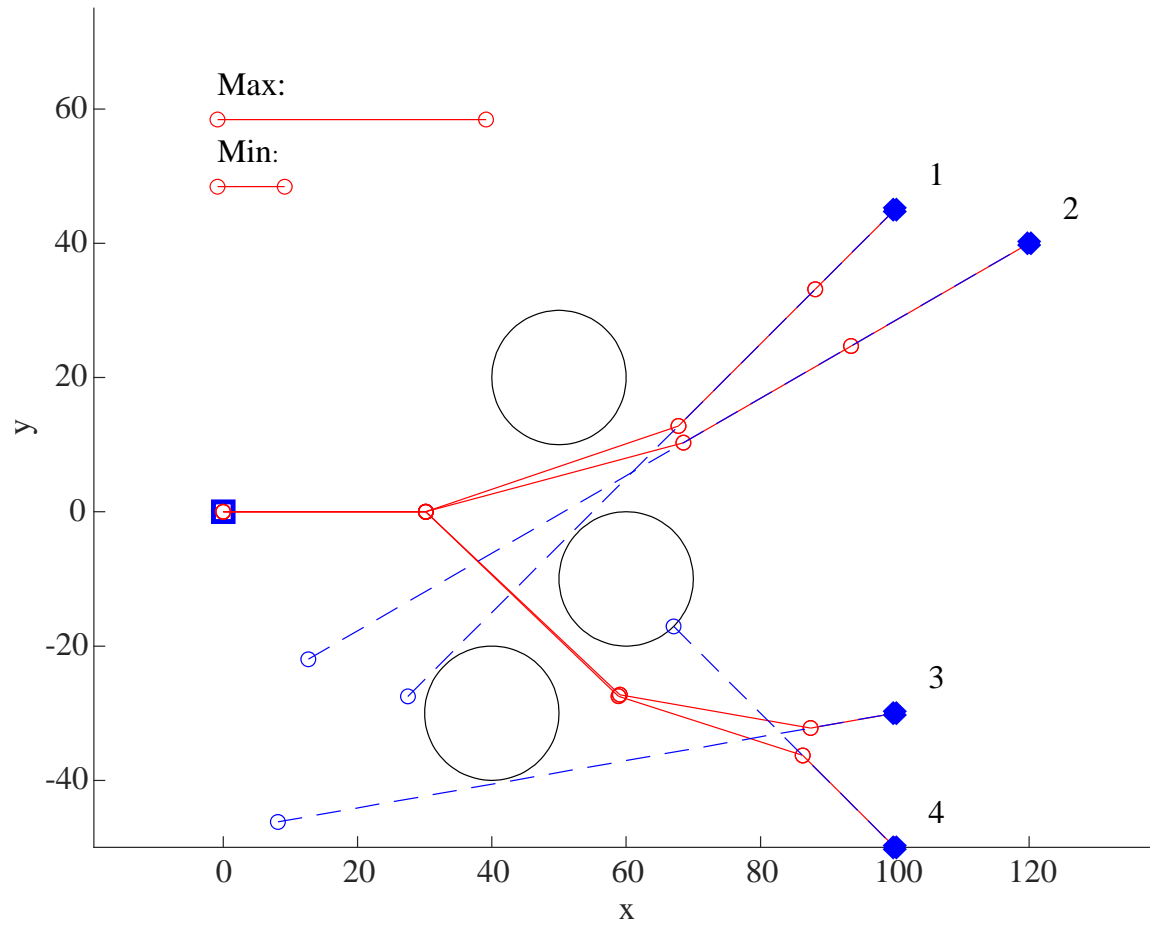
- kmeans for clustering
- circirc, syms for obstacle avoidance
- simulink for calculating force transmission given a defined robot
- par-for for parallel computation (when applicable)
- All figures, plots, and charts in scientific articles are only produced with MATLAB in vector form

- **Optimization**
- **Simulink**
- **Statistics and Machine Learning**
- **Symbolic Math**
- **Mapping**
- **Parallel Computation**

## Benefits / added value of using MATLAB and Simulink

- Visualize data with plots and create animations
- Debug and access values
- Ability to perform complex matrix operations in a single line of code
- Solving complex equations
- Simulating real systems with Simulink
- Communication with other languages like C++ for specific and efficient software
- Ability of writing file in excel to save data
- Graphics are good looking and always recommended when adding figures in scientific papers

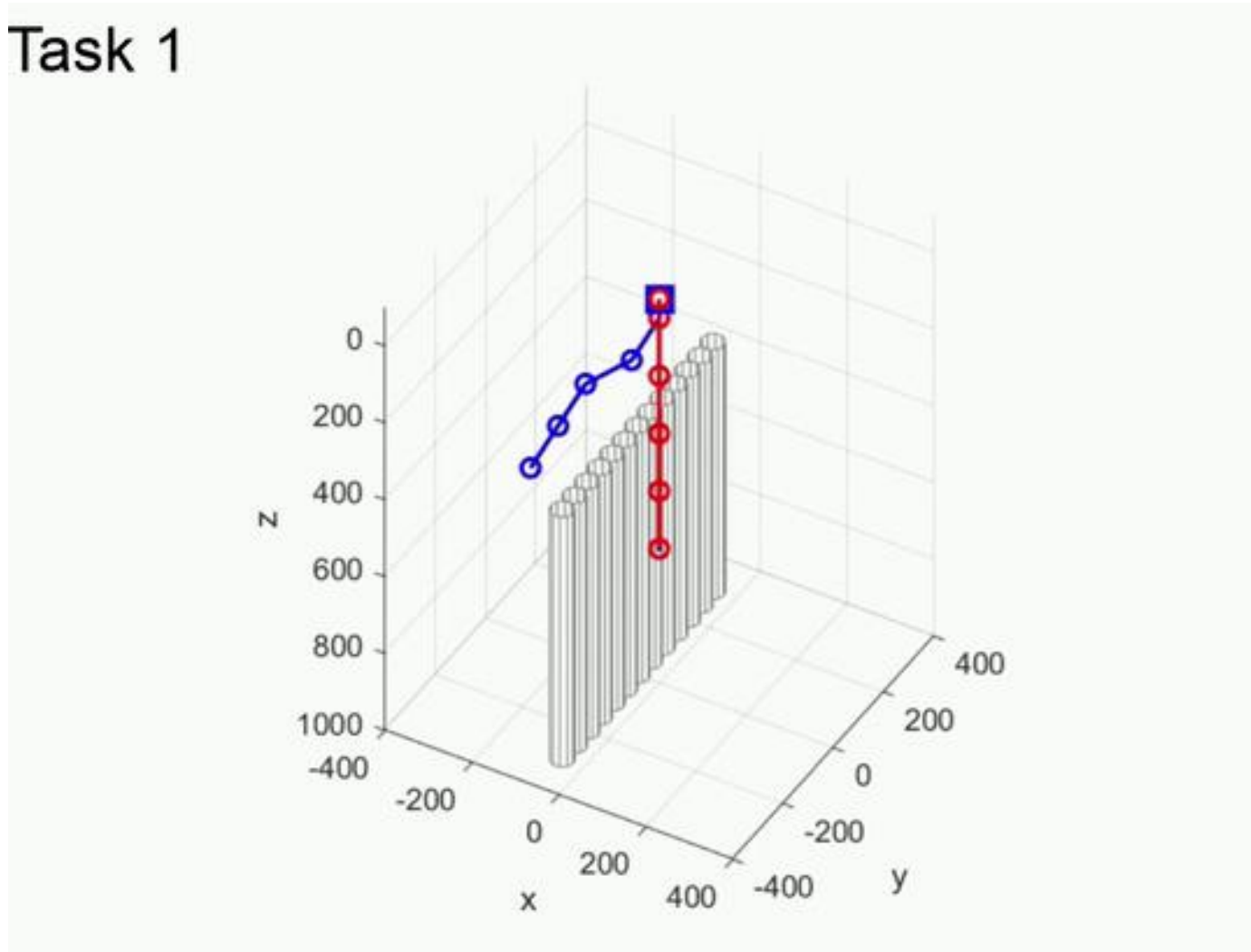
# Results obtained and personal considerations



Optimal Robotic Designs

# Results obtained and personal considerations

## Task 1



Optimal Path

## Future plans

- Exploit Matlab Parallel Computation
- Creating a Mathworks space with EVO Lab's Matlab scripts
- Creating easy toolbox for soft-growing robot optimization
- Creating animations for drone-ground robot rendezvous schedule while scanning areas



# Thank you

## Q&A – 5min



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