A Gazebo Simulator for Continuum Parallel Robots

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- Serial robots
  - Simpler and more used
  - Limited by precision and inertia
- Parallel robots
  - Less inertia, high velocities
  - More joints involved

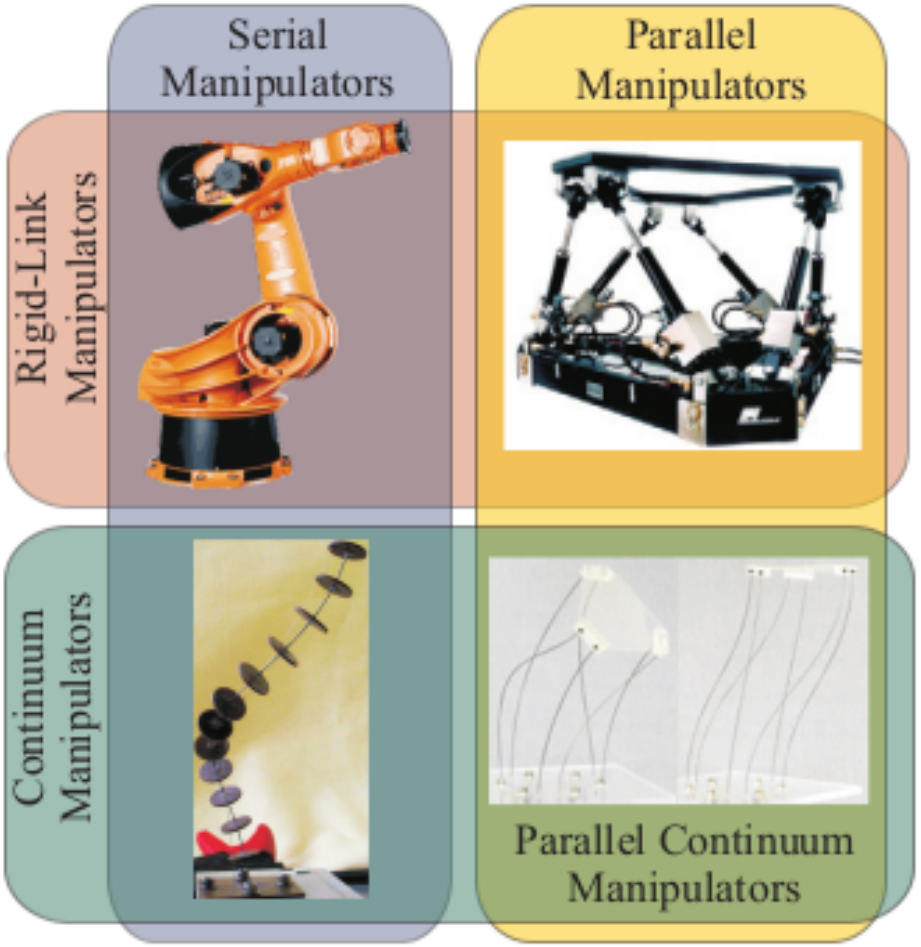

Figure: Different robot architectures

- Continuum parallel robots
  - May anhance safety
  - Cheaper components
  - Possible to miniturize
- Model and stability problems
  - More unstable configurations
  - Another drawback
  - Not analytical solution

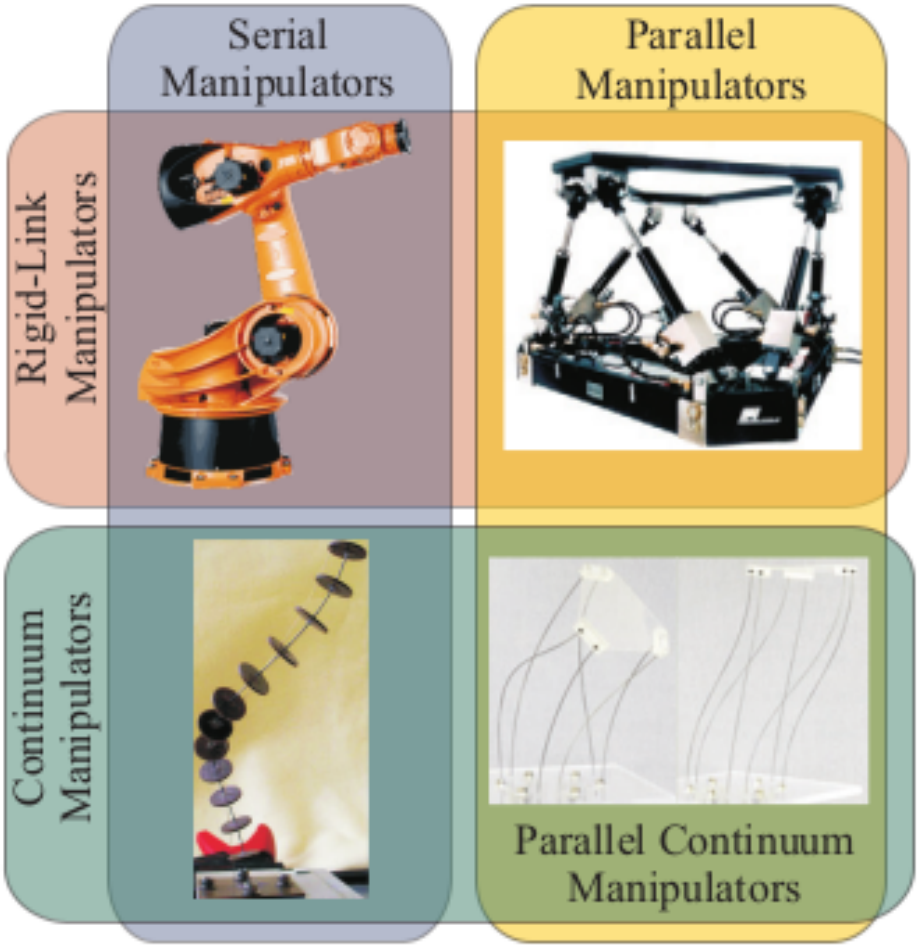

Figure: Different robot architectures.

CPR simulator

- General simulator
  - Gazebo
  - Different robots
- Solve the modelling
  - Rod statics
  - Robot assembly
  - Visual interface
  - Robot dynamics

Geometric modelling

- Rod as 1D body
- Function of the arc-lenght
  - Centerline position
  - Cross-section orientation

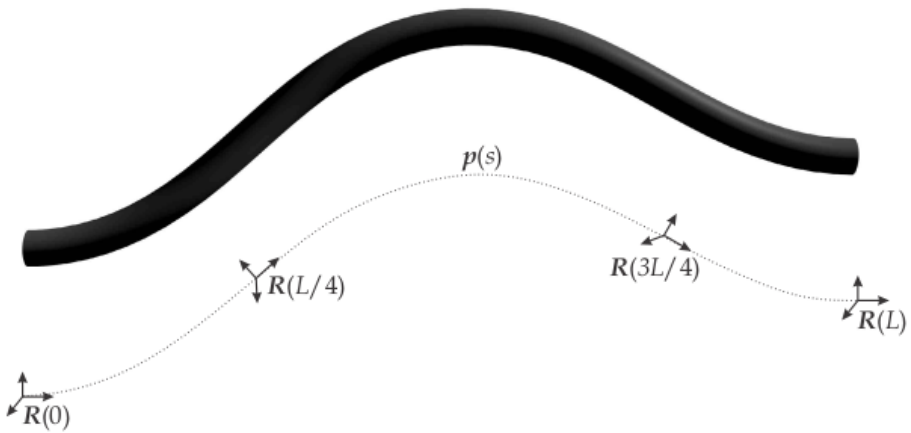

Figure: Rod geometric modelling

Equilibrium Equations

- Equilibrium consideration
  - Distributed forces/moments
  - Internal forces/moments

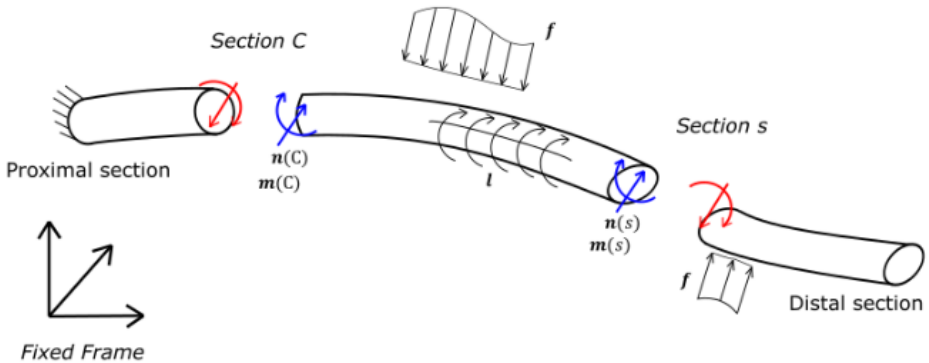

Figure: Sections of the beam considered for the static equilibrium.

- Boundary value problem
- Constraints at the platform
  - External wrench
  - Joints and geometry
- Constraints at the base
  - Actuations
  - Joints and geometry

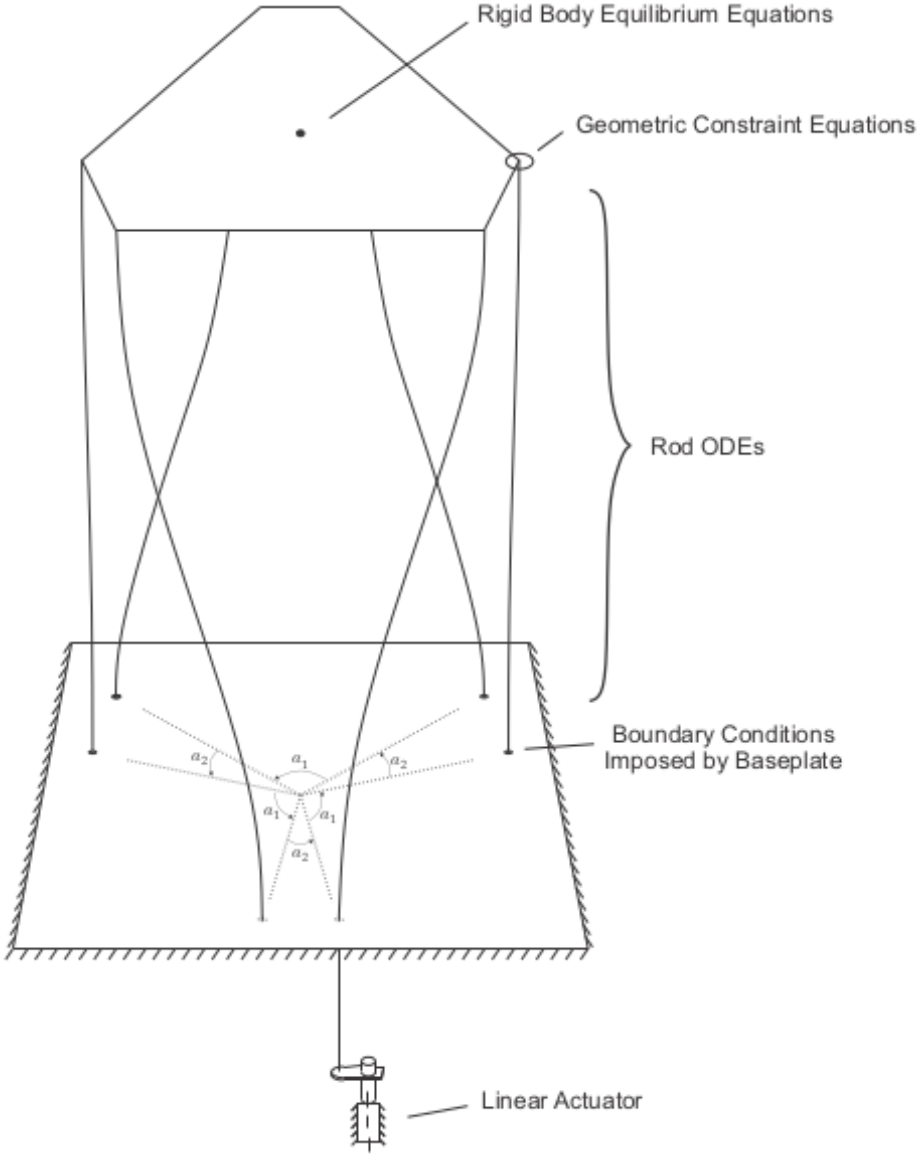

Figure: Sections of the beam considered for the static equilibrium.

- Shooting Method
  - ODE system in statics
  - Needs an intial guess
  - Recursive
- Evaluation on a cost function
- Sensitive to initial conditions

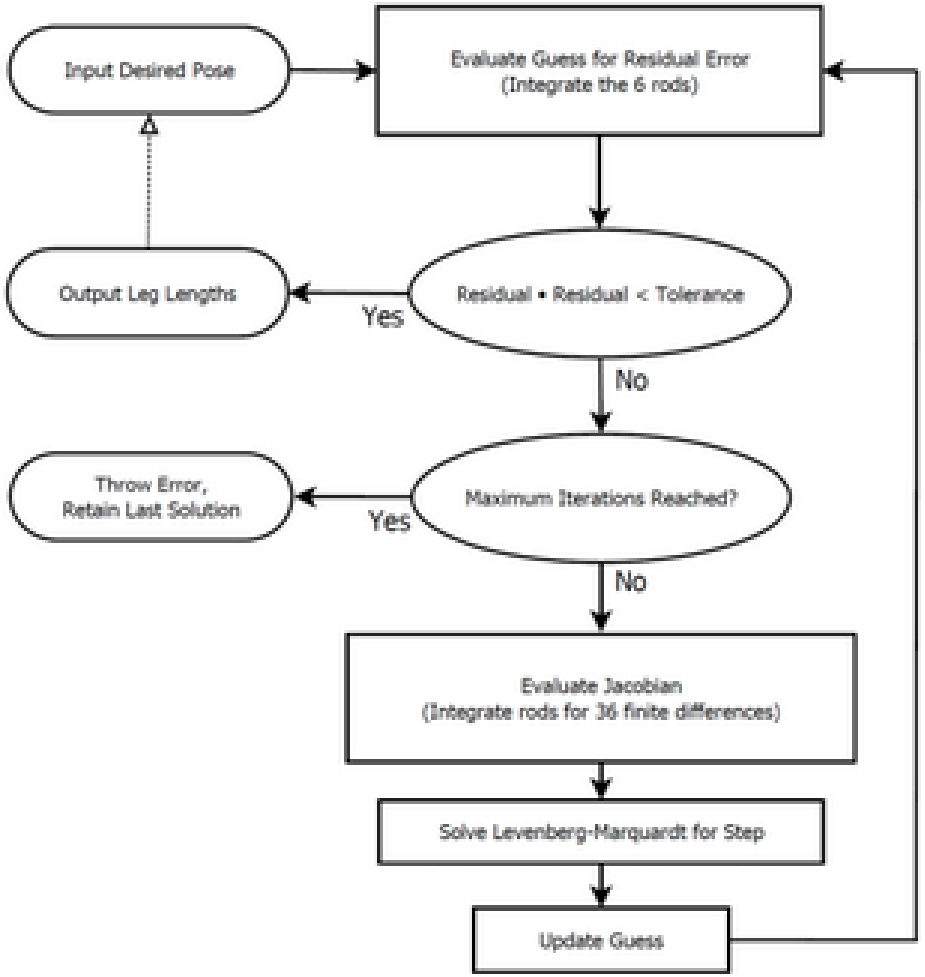

Figure: Recursive process for Shooting method.

- Shooting Method
  - PDE system in dynamics
  - Numerical discretization
  - Recursive
- Evaluation on a cost function
- Sensitive to initial conditions

- Strain Approach
  - Intro here

- Strain Approach
  - Details here

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