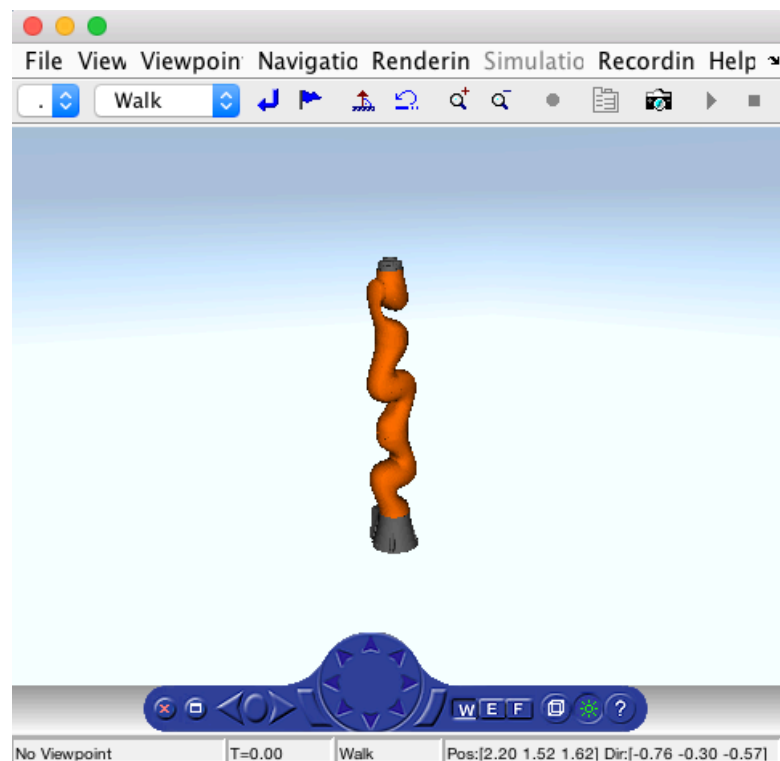


Simulácia robotov v 3D prostredí

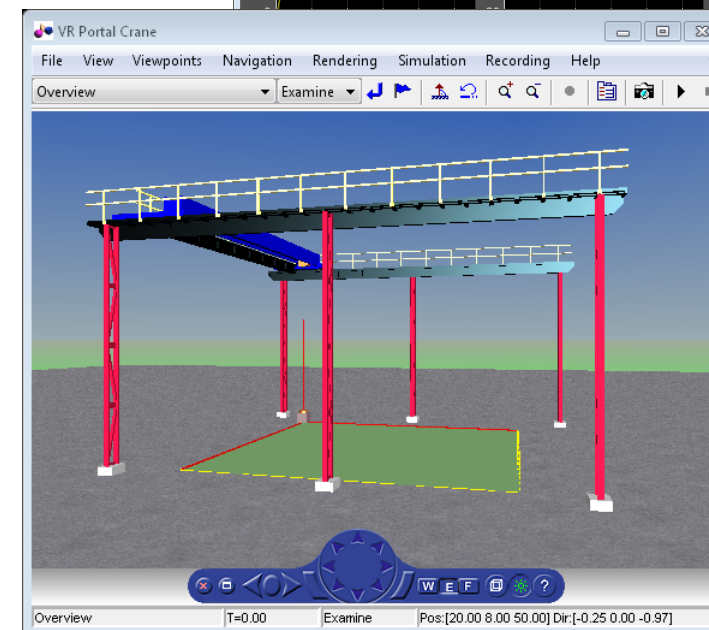
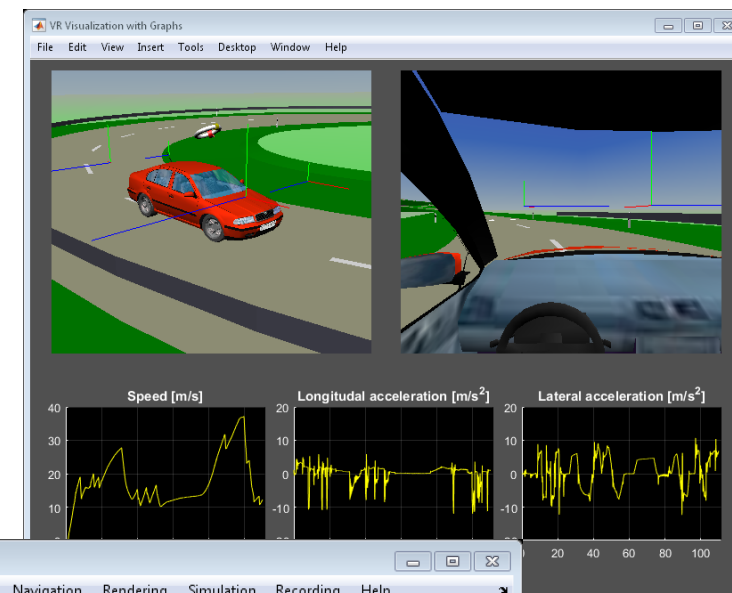


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Vizualizácia a verifikácia dynamických systémov

- **Simulink 3D Animation**
 - VRML, X3D
 - Predtým známy ako Virtual Reality Toolbox
 - 8 Mar, 2000 16:47:10, MATLAB Newsgroup
- **Tvorba virtuálnych svetov**
- **Interakcia so svetom**
- **Prepojenie so Simulinkom, Simscape**
- **Tvorba animácii, obrázkov**
- **Import**
 - CAD modelov
 - Modelov robotov



Popis robota v 3D

- **Unified Robotics Description Format (URDF)**

- Populárny v Robotics Operating System (ROS)
- XML špecifikácia

- **Elementy – robot, joint, link**

- **<robot>**

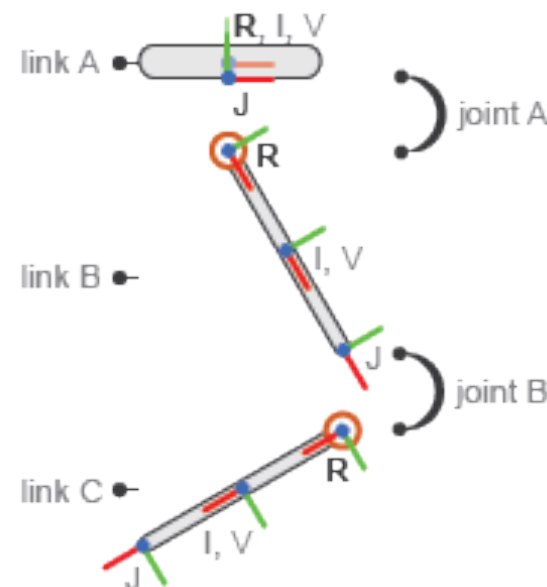
- Koreňový element robota

- **<link>**

- geometria, materiál, zotrvačnosť, ...

- **<joint>**

- hierarchia – parent, child
- typ prepojenia – prismatic, revolute



```

<robot>
  <link>
    ...
  </link>
  <link>
    ...
  </link>
  <joint>
    ...
  </joint>
</robot>

```

Import robota

- **Simscape**

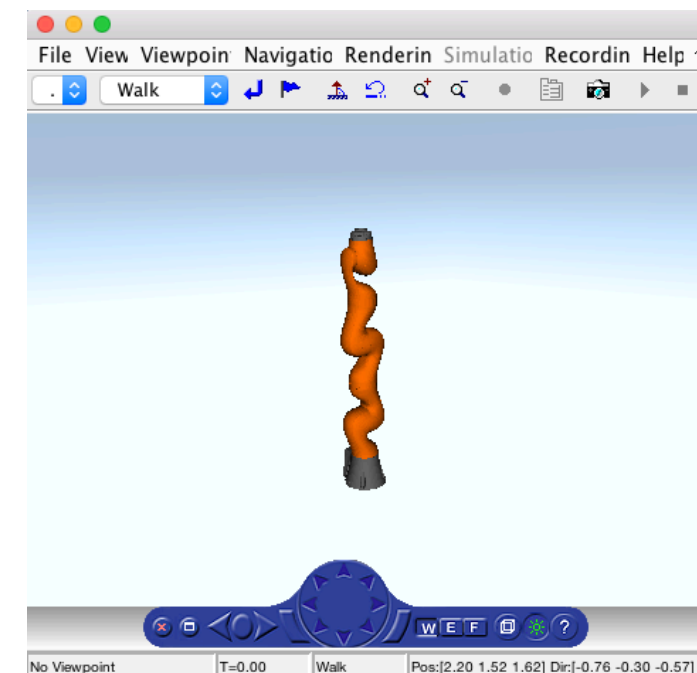
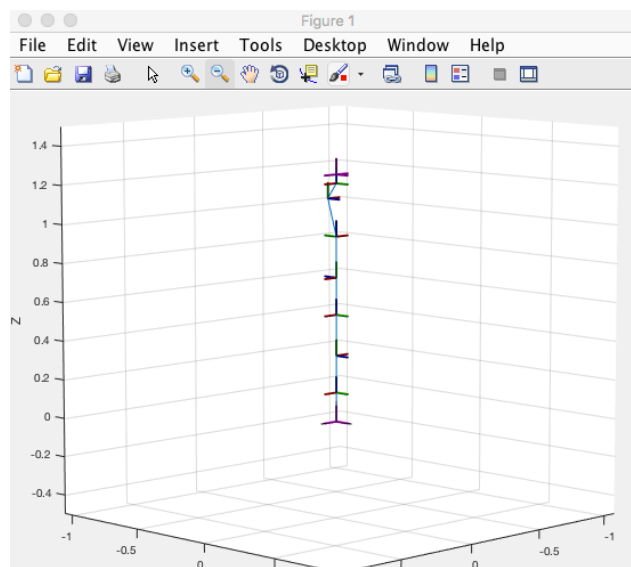
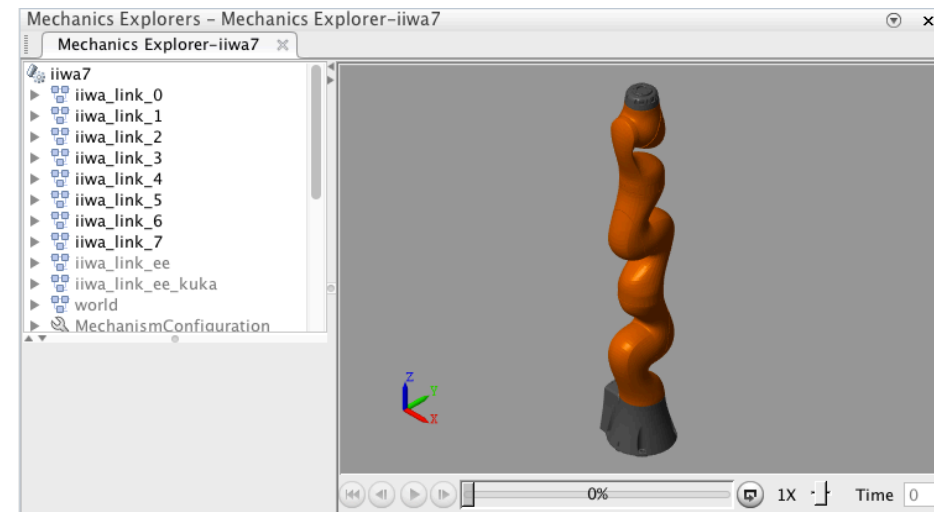
- `smimport('iiwa7.urdf')`
- Vygeneruje Simscape Multibody model
- Nedokáže – scale (mesh), textúry, SDF

- **Robotics System Toolbox**

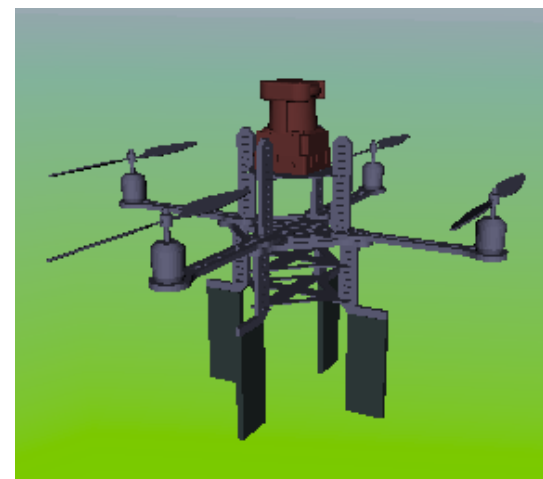
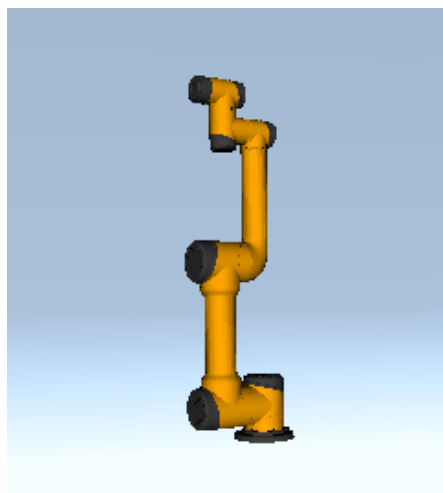
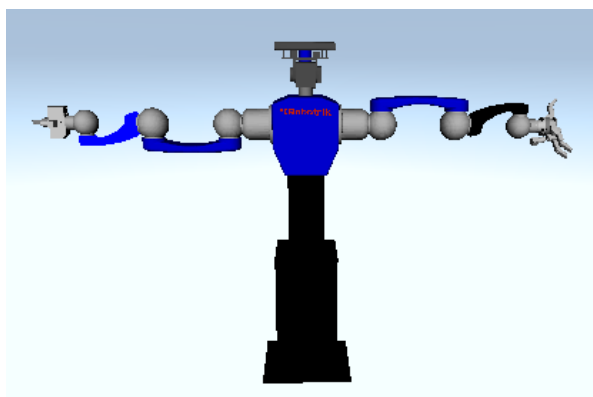
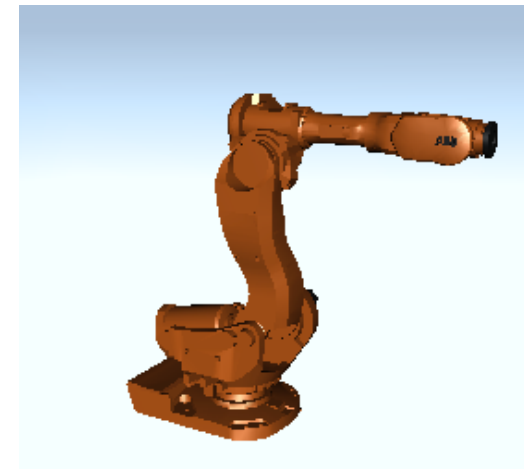
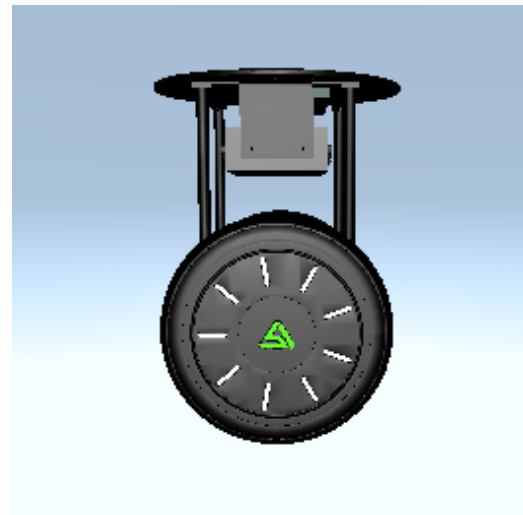
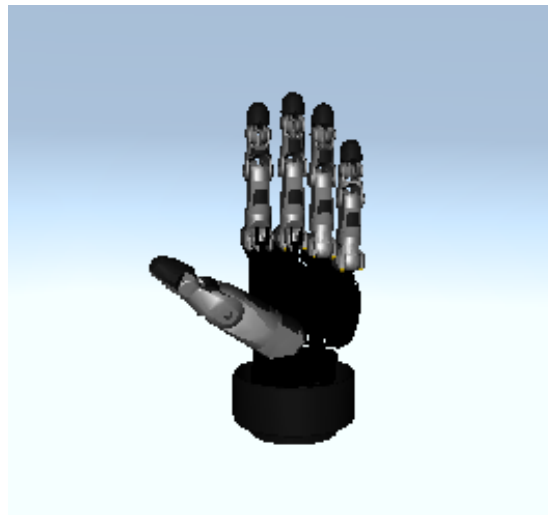
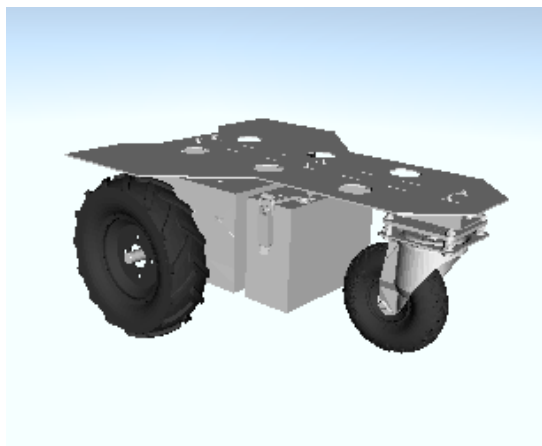
- `robot = importrobot('iiwa7.urdf')`
- Vrátí `robotics.RigidBodyTree`

- **Simulink 3D Animation**

- `[n,w] = vrimport('iiwa7.urdf')`
- Vrátí 3D svet
- Pohyb v osi – prefix `axis_`
- Alternatíva – vredit



Priklady importov



Algoritmy manipulátorov

- **Vytvorenie robota**

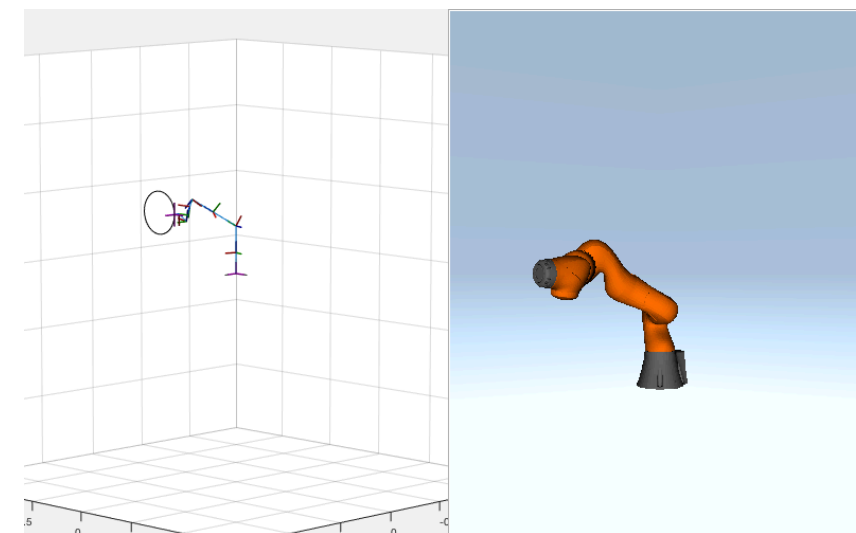
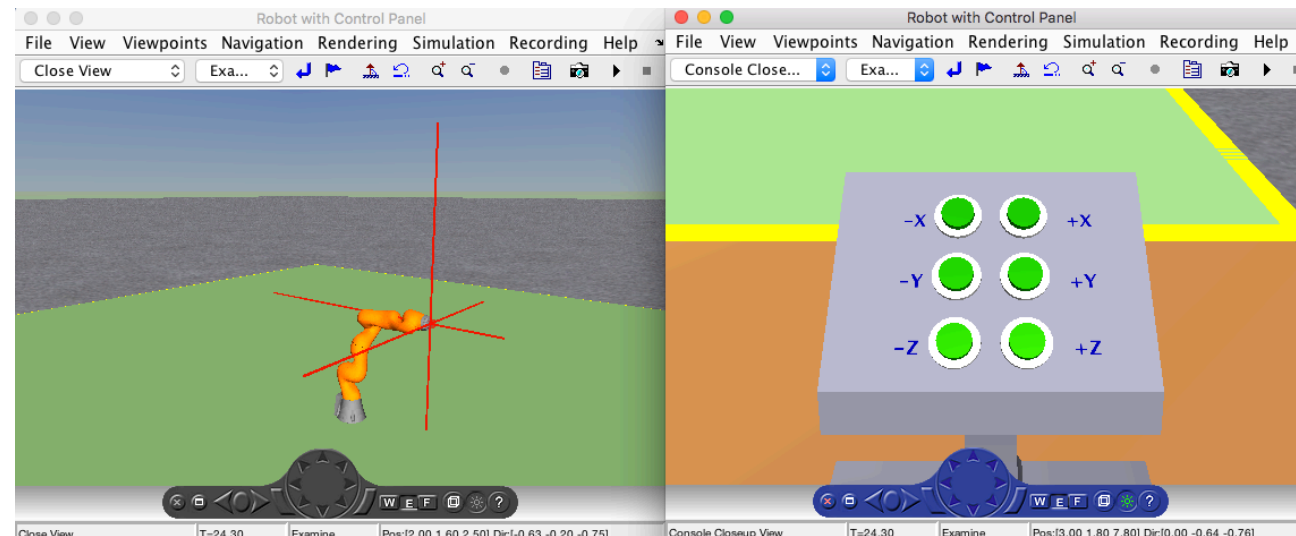
- Nemáme URDF
- `robotics. +`
 - `RigidBodyTree`, `RigidBody`, `Joint`
 - `addBody`, `setFixedTransform`

- **Inverzná Kinematika**

- Uhly pre dosiahnutie pozície
- `robotics.InverseKinematics`

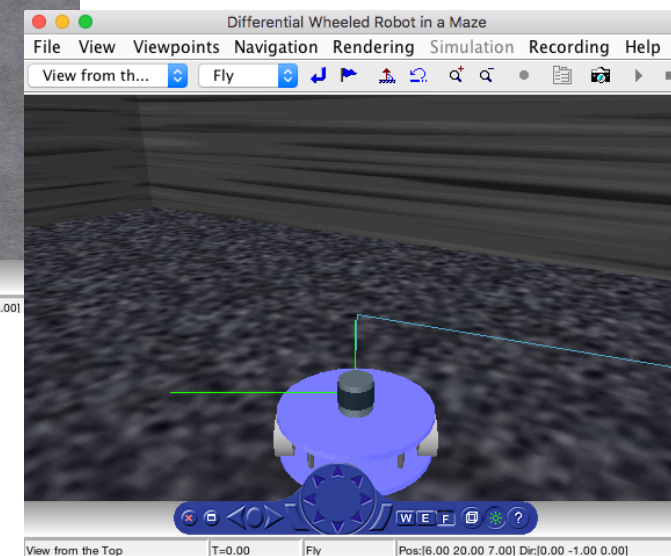
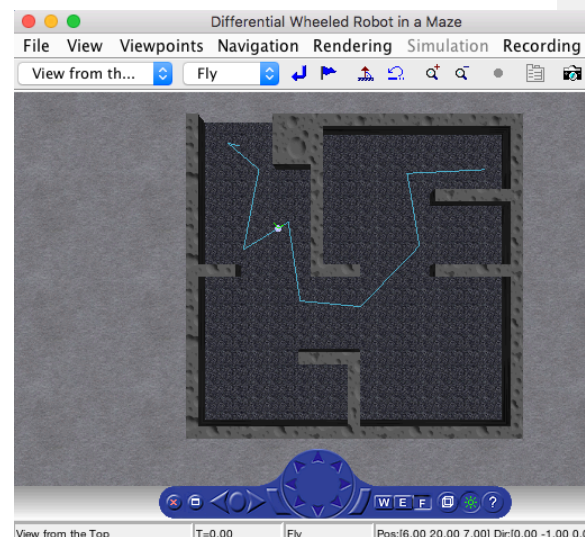
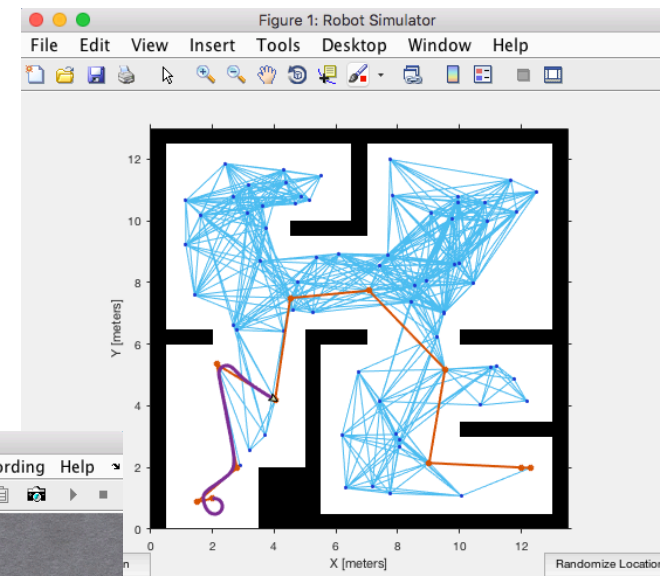
- **IK s obmedzeniami**

- `robotics.GeneralizedInverseKinematics`
 - Orientácia
 - Poloha
 - Jointy, ...



Mobilná robotika

- Práca s mapou
 - `robotics.BinaryOccupancyGrid`
- Plánovanie trasy (pravdepodobnostné)
 - `robotics.PRM`
- Riadenie pohybu
 - `robotics.PurePursuit`
- Vyhýbanie prekážok
 - `robotics.VectorFieldHistogram`
- Odhad stavov
 - `robotics.ParticleFilter`
 - `robotics.MonteCarloLocalization`



Zhrnutie

- **Simulink 3D Animation**
 - Vizualizácia a verifikácia v 3D
- **Možnosť importu modelov robotov**
 - URDF, SDF
- **Robotics System Toolbox**
- **Algoritmy manipulátorov**
 - Inverzná kinematika
 - Obmedzenia
- **Mobilná robotika**
 - Práca s mapou
 - ...

Ďakujeme