A Session on "We Learn Dynamics" (WeLD)

Getting Started with Dynamic Simulation in Autodesk Inventor

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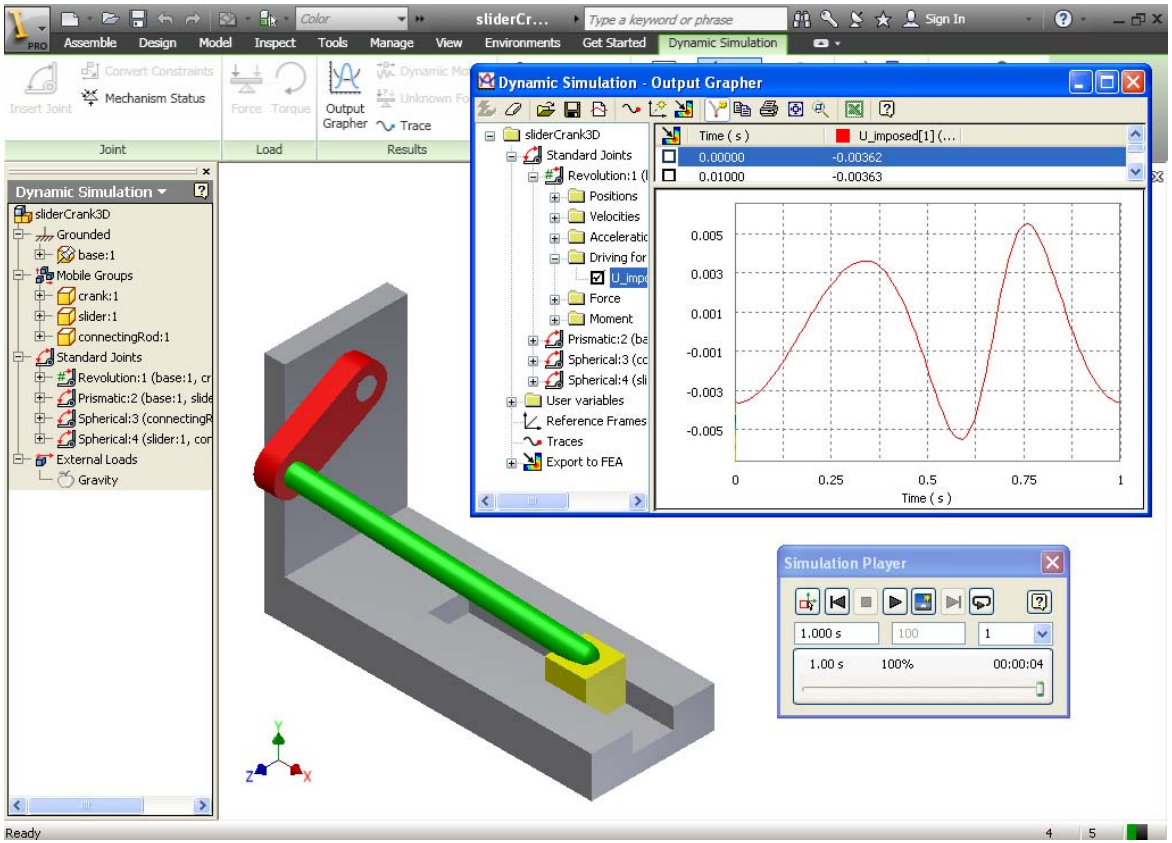
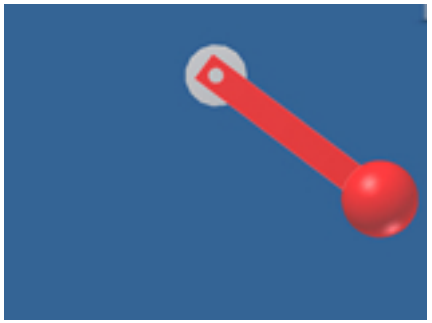
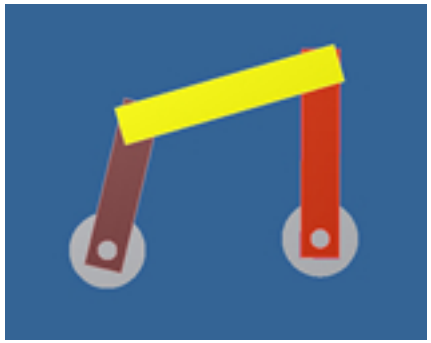


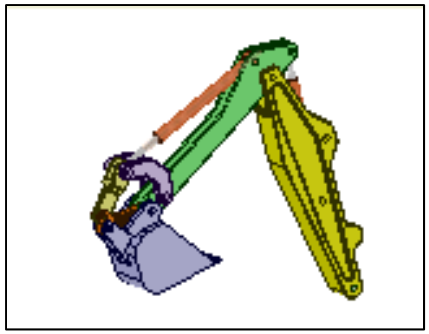
Contents

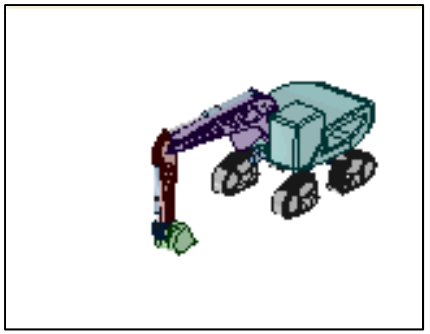
Mechanisms (Machines)

- Moving Parts
- Joints
- Degrees of Freedom (DOF)









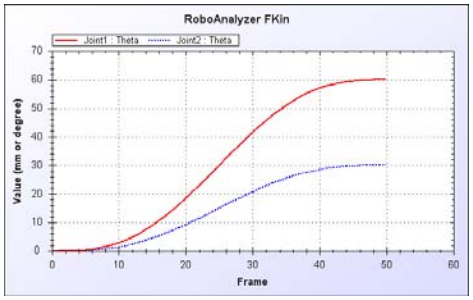
Kinematics

Study of motion of links without considering the forces

Forward Kinematics

Inverse Kinematics

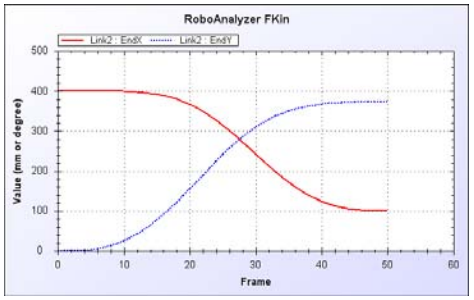
Joint Value

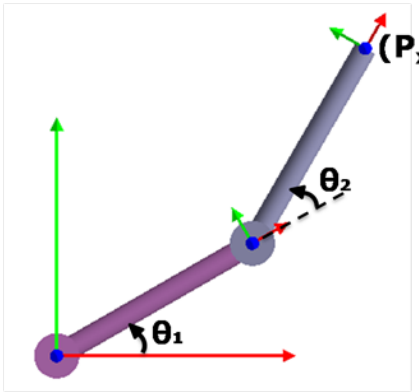


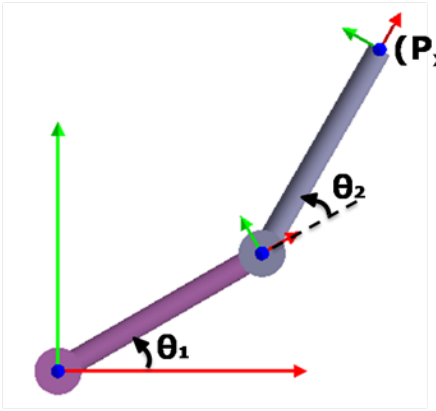
Forward Kinematics

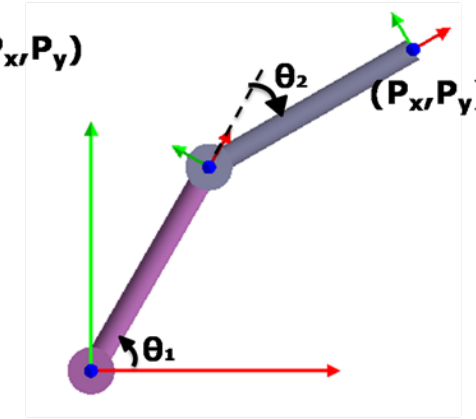
Inverse Kinematics

Part Config.









Unique and straight forward solution

Multiple solutions.

Solving is comparatively complex

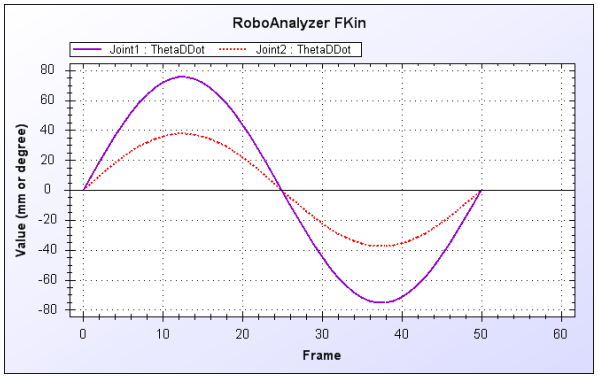
Dynamics

Study of forces and moments causing the motion of links

Forward Dynamics

Inverse Dynamics

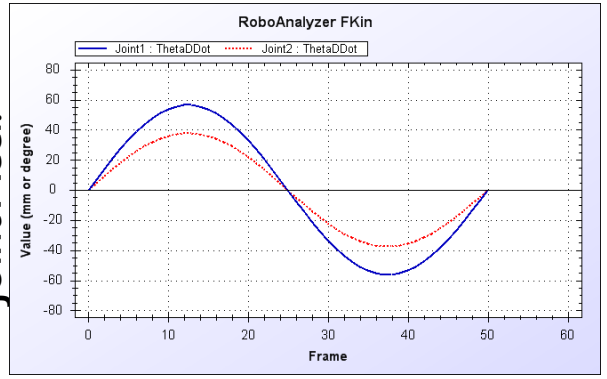
Joint Force



Forward Dynamics

Inverse Dynamics

Joint Accl.



Inversion of Matrix

Simulation requires ODE solution

Straight forward

Autodesk Inventor

- 3D Mechanical CAD Software (1999V1- 2013)
- Developed by Autodesk Inc. (USA)
- Similar Software:
  - SolidWorks (Dassault)
  - SolidEdge (Seimens PLM)
- Features:
  - Part Modeling
  - Assembly Modeling
  - Dynamic Simulation
  - Stress Analysis
  - …

Part Modeling

- Create Sketch
- Feature Based Modeling:
  - Extrude
  - Revolve
  - Sweep
  - …
- Result: 3D Solid
  - Mass
  - Inertia
  - Center of Mass

Assembly Modeling

- Place (Import) Parts
- Define Assembly Constraints (Geometric):
  - Mate
    - Surfaces
      - Planar
      - Cylindrical
      - Spherical
    - Geometry
      - Edge (Linear/ Circular)
      - Point
  - Insert (Revolute): Circular Edges
  - Tangent : Surfaces
  - Angle: (Surfaces/Edges)

Dynamic Simulation Module

- Fully Integrated
- Converts Constraints to Joints (Mechanical)
  - Verify
- Motion (Kinematic) Simulation
  - Define Joint Rotation: Simulate
  - Plots

- Dynamic Simulation
  - Define Gravity: Simulate
  - Free-fall: Simulate

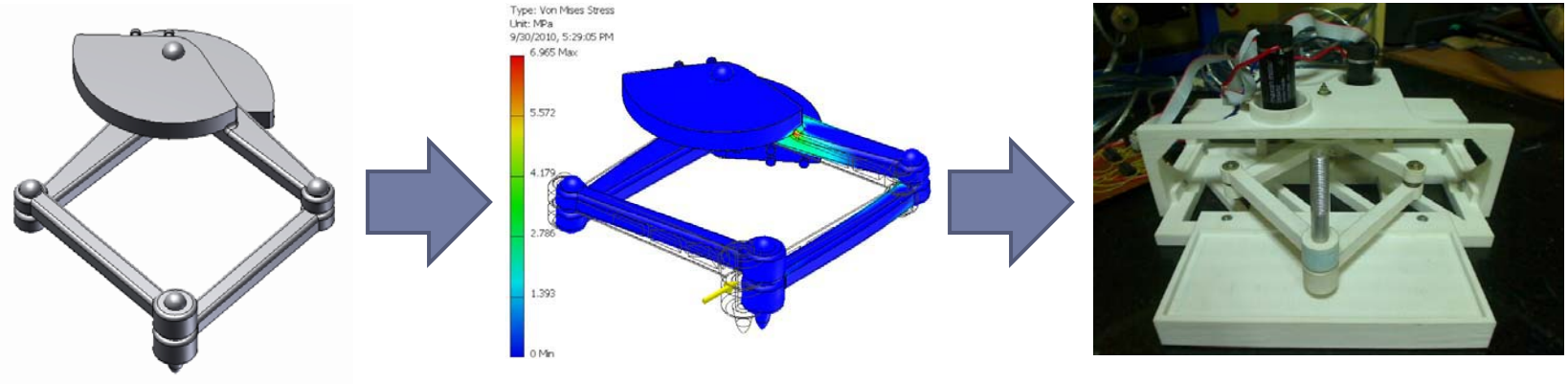
Examples

Other Features

- Export Graph Plots to MS Excel, CSV
- Record Video

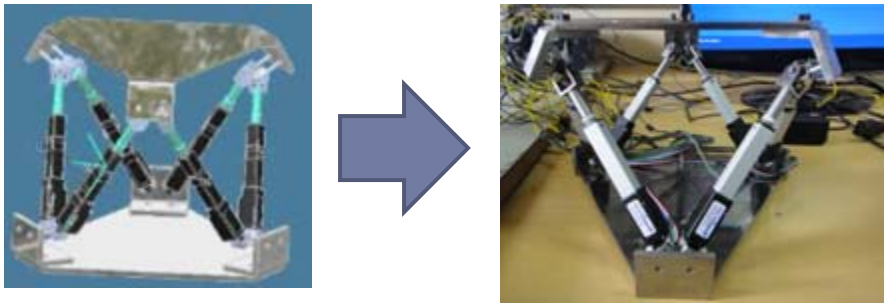
Use in Research (Mechatronics Lab)

- CAD Modeling: Haptic Device RP Model



Majid Koul and Dmitri Rabinowitz(Rice Univ. USA)

- Design of 6DOF Motion Platform

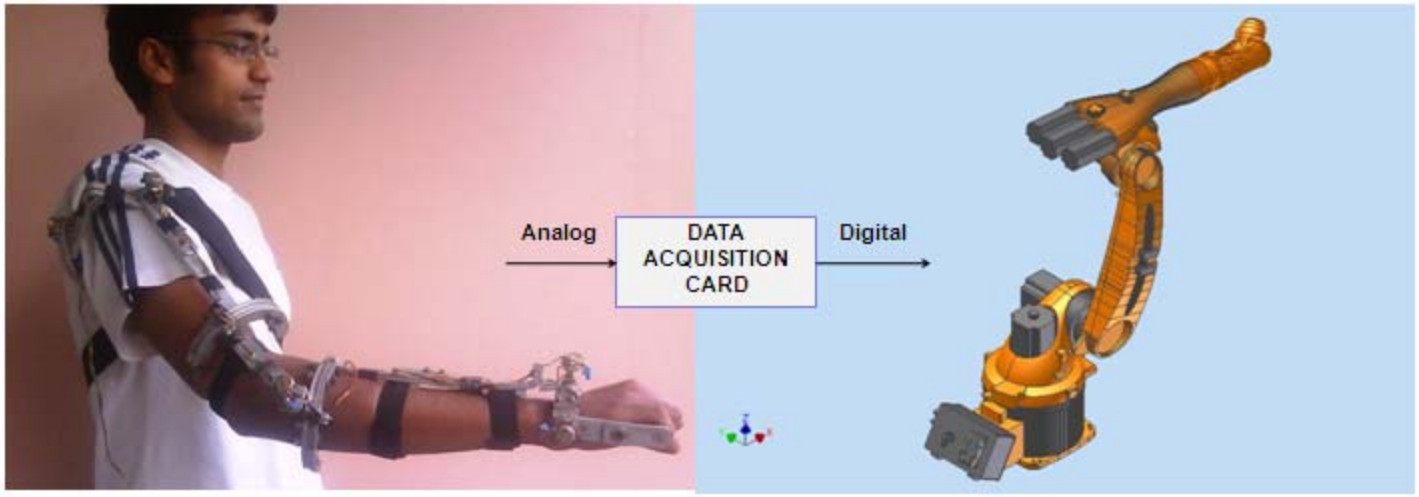


Video

Raghav Bhagat and Siddharth Choudhury (BTP)

Use in Research (Mechatronics Lab)

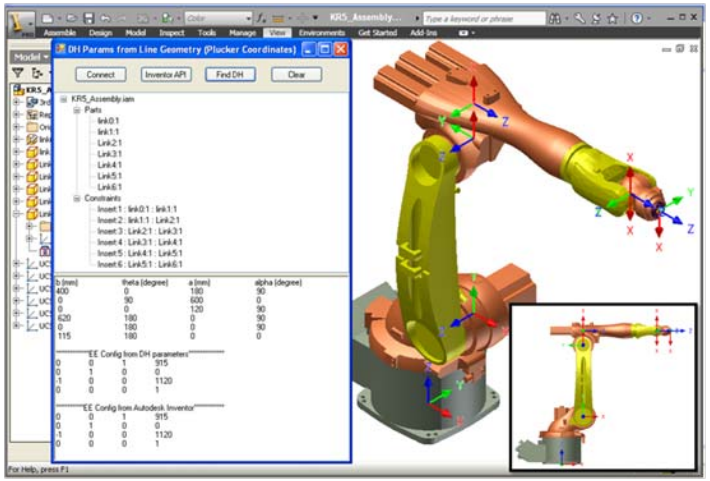
- CAD Modeling: Exo-Skeleton



Prof. S. Mukherjee and Team

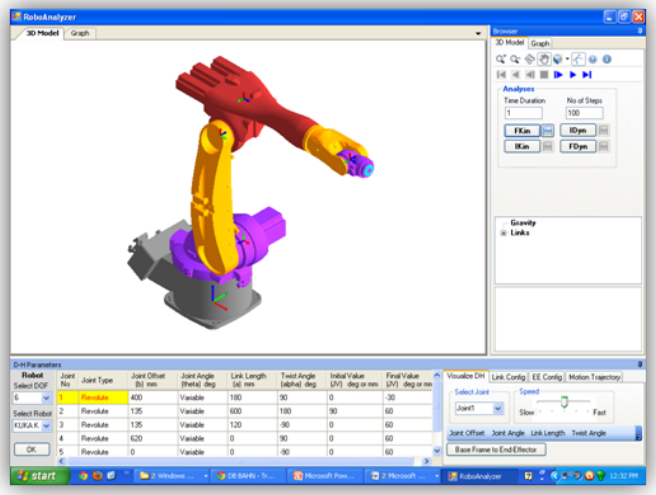
Use in Research (Mechatronics Lab)

- Application Programming Interface (API)
  - Extraction of DH Parameters of Serial Robot



Addin inside Autodesk Inventor

Video



RoboAnalyzer
(http://www.roboanalyzer.com

Video

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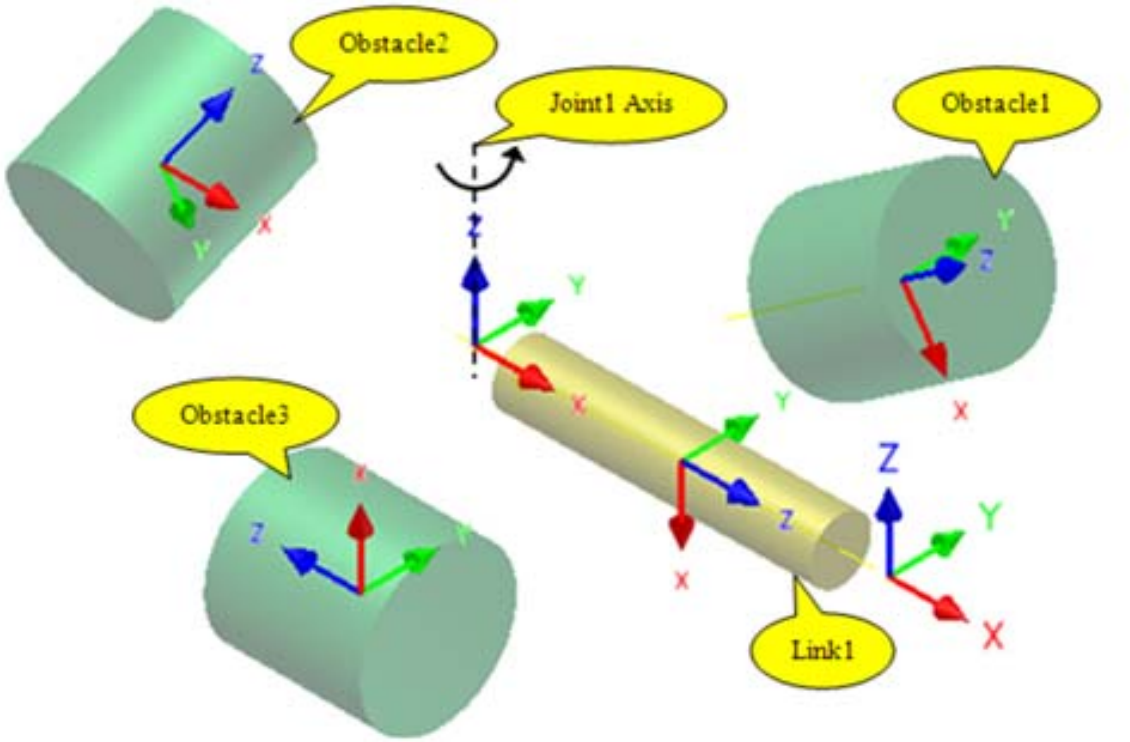
Use in Research (Mechatronics Lab)

- Application Programming Interface (API)
  - Collision Detection of Cylinders



Video

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Resources

- Software: Free for Academic Use*
  - http://students.autodesk.com
- Tutorials
  - Youtube and http://students.autodesk.com
- Inventor Assembly Models
  - http://www.ar-cad.com/in-motion/examples.html
- General CAD Models (Must See!!!)
  - http://www.GrabCAD.com
- Inventor API Tutorials
  - http://www.smallguru.com

*Please review License Agreement Carefully

Thank You

- Autodesk India Pvt. Ltd
  - Free ‘ADN’ Membership
- Members of Mechatronics Lab
  - Mutual help in learning Autodesk Inventor
- Prof. S.K. Saha and WeLD Team
  - For giving this opportunity