3D Visualization with Modelica

Application of Modelica in Robotics Models Real-time Training Simulator for Flight, Driving

- Using Modelica models generating real-time code
- Different simulation environments (e.g. Flight, Car Driving, Helicopter)
- Developed at DLR Munich, Germany
- Dymola Modelica tool

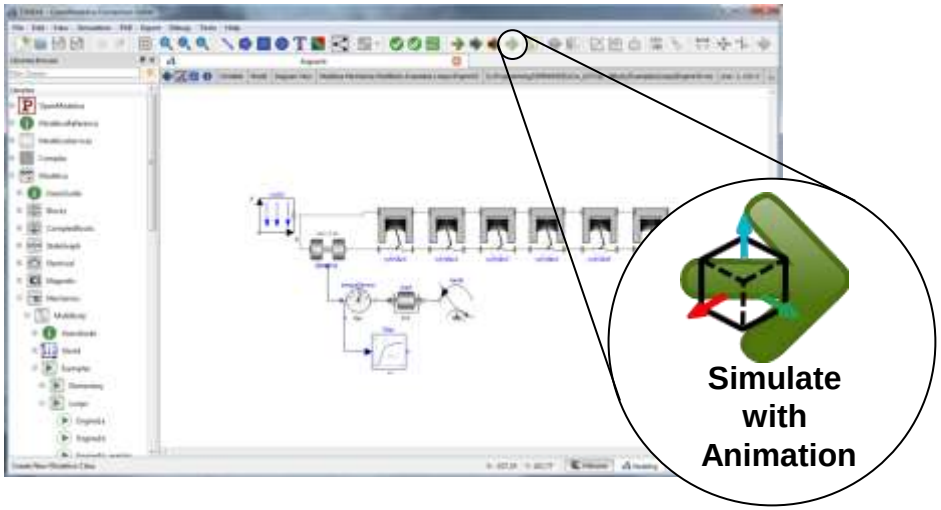
(Movie demo next page)

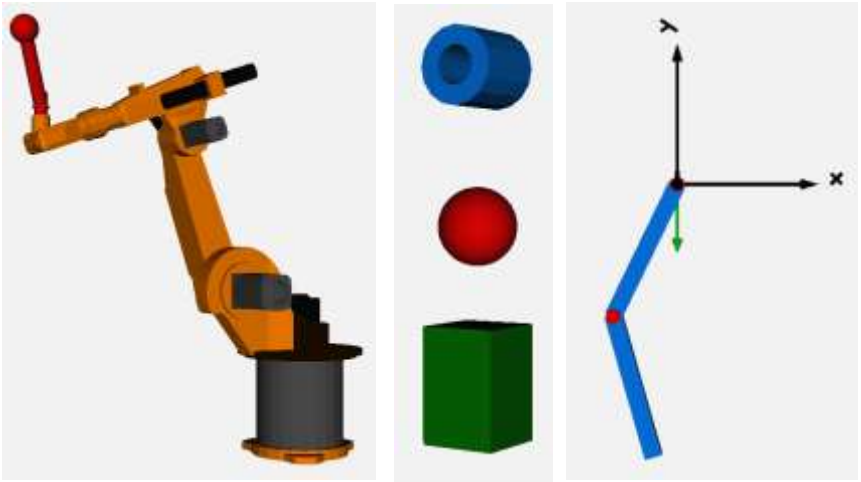
Courtesy of Tobias Bellmann, DLR, Oberphaffenhofen, Germany

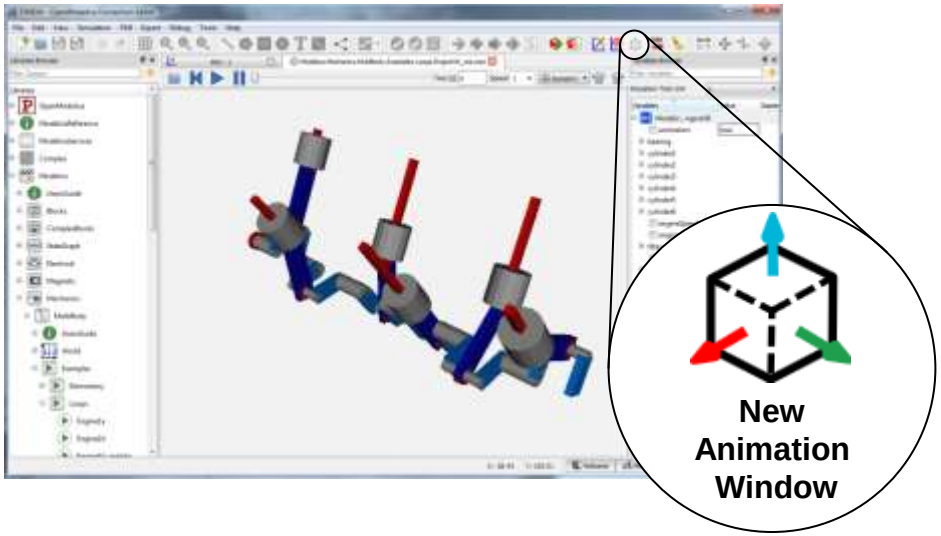
DLR Real-time Training Simulator Movie Demo

OMEdit 3D Visualization of Multi-Body Systems

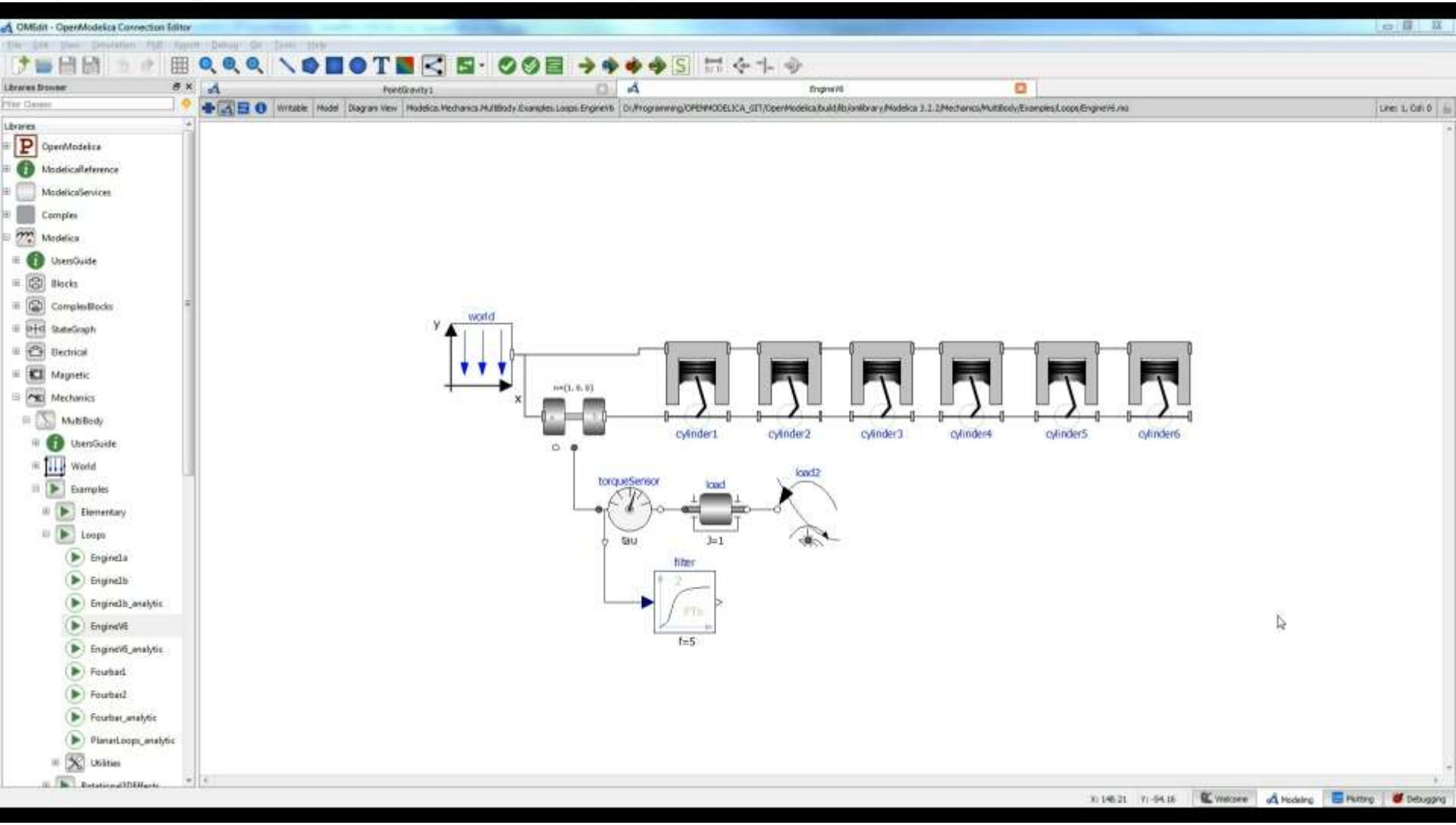
- Built-in feature of OMEdit to animate MSL-Multi-Body shapes
- Visualization of simulation results
- Animation of geometric primitives and CAD-Files



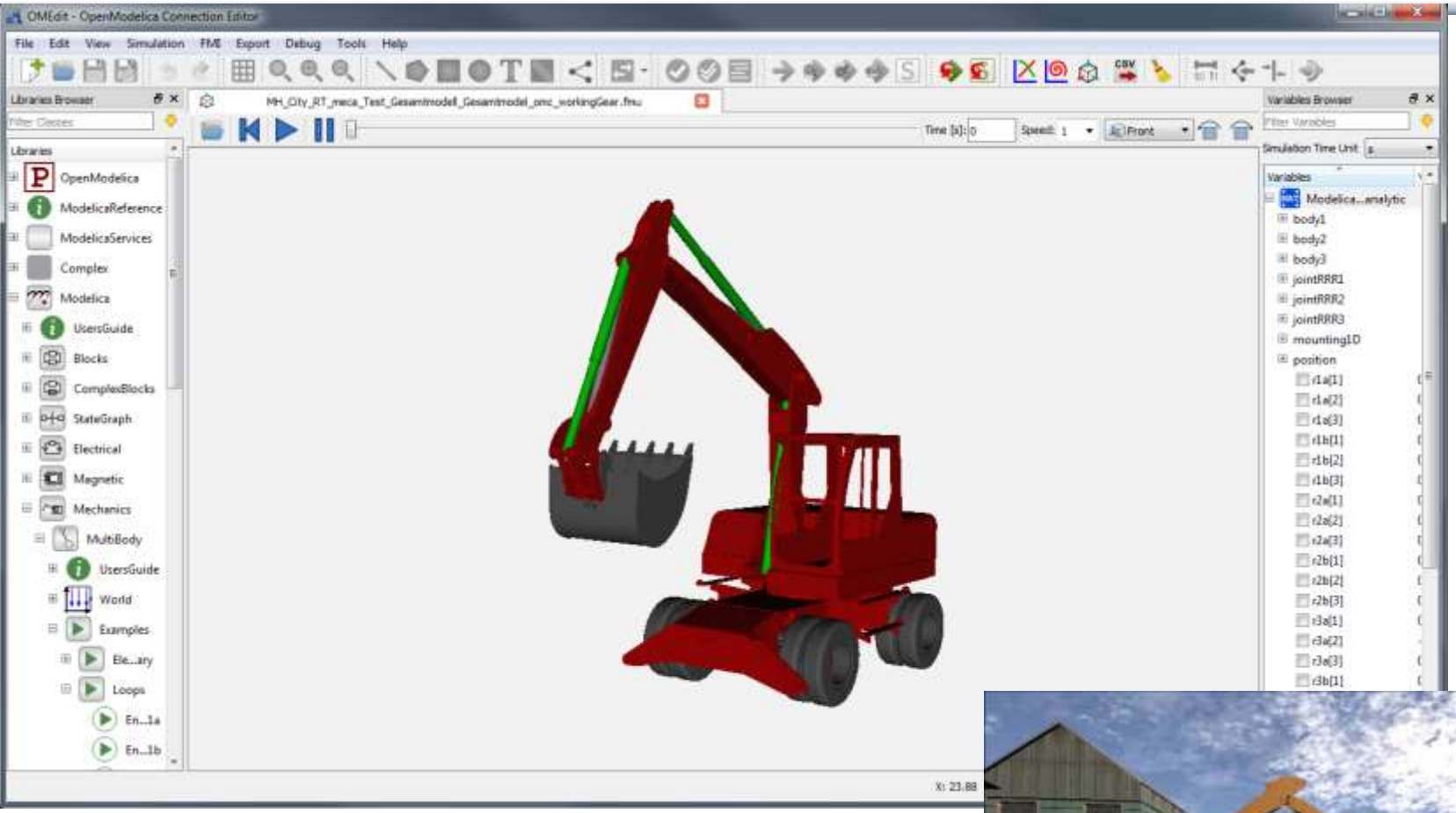




OpenModelica 3D Animation Demo
(V6Engine and Excavator)



OpenModelica 3D Animation – Excavator

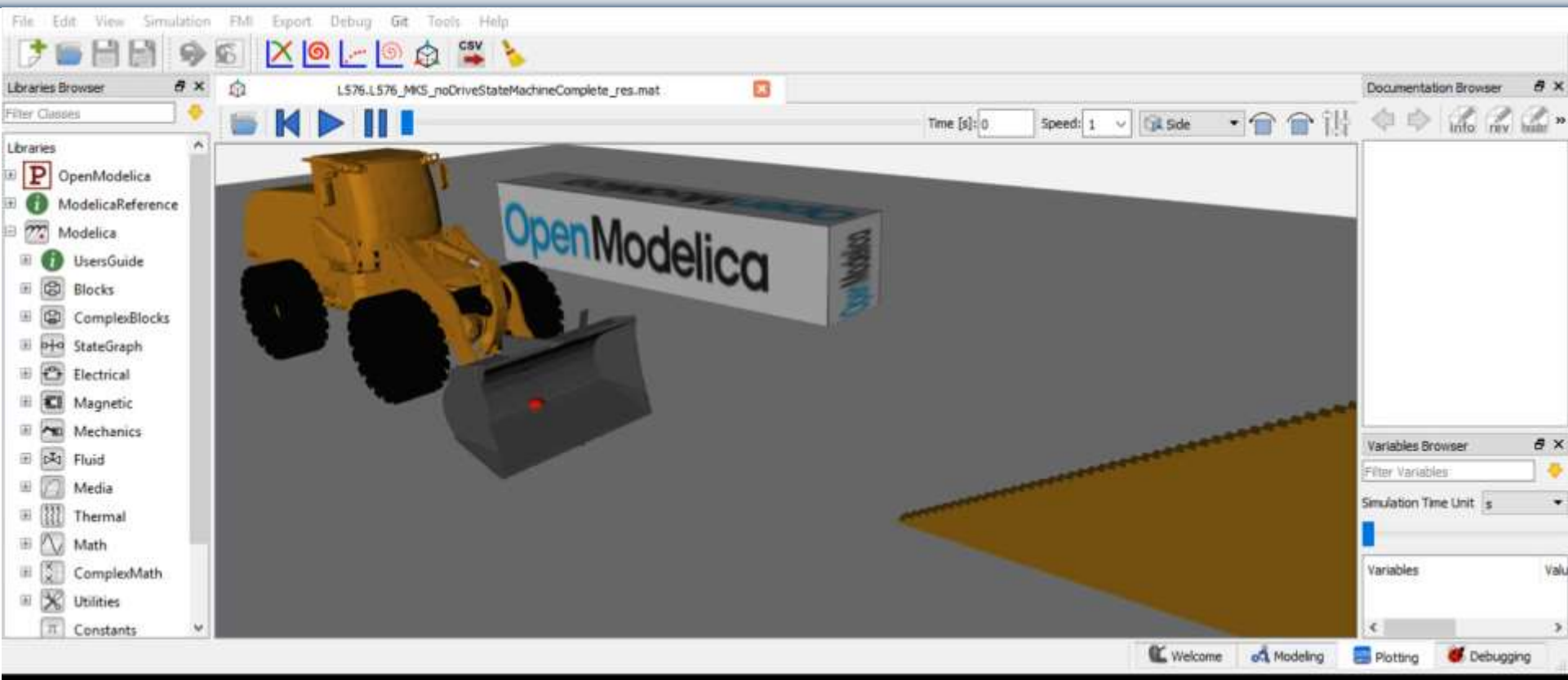


unity

Connection with Unity

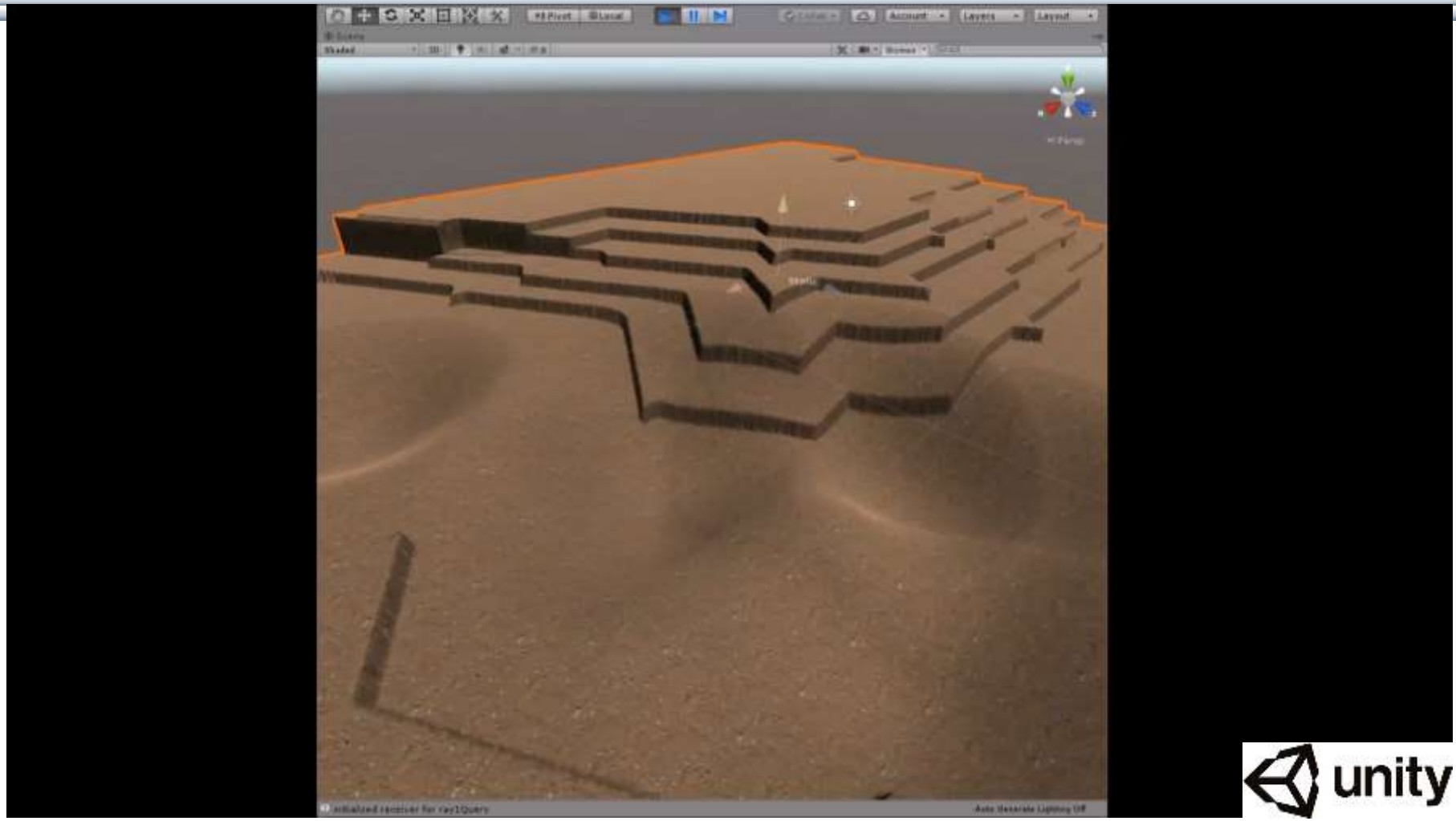
Courtesy of Volker Waurich - TU Dresden

OpenModelica 3D Animation – WheelLoader



Courtesy of Volker Waurich - TU Dresden

OpenModelica 3D Animation – BouncingBall

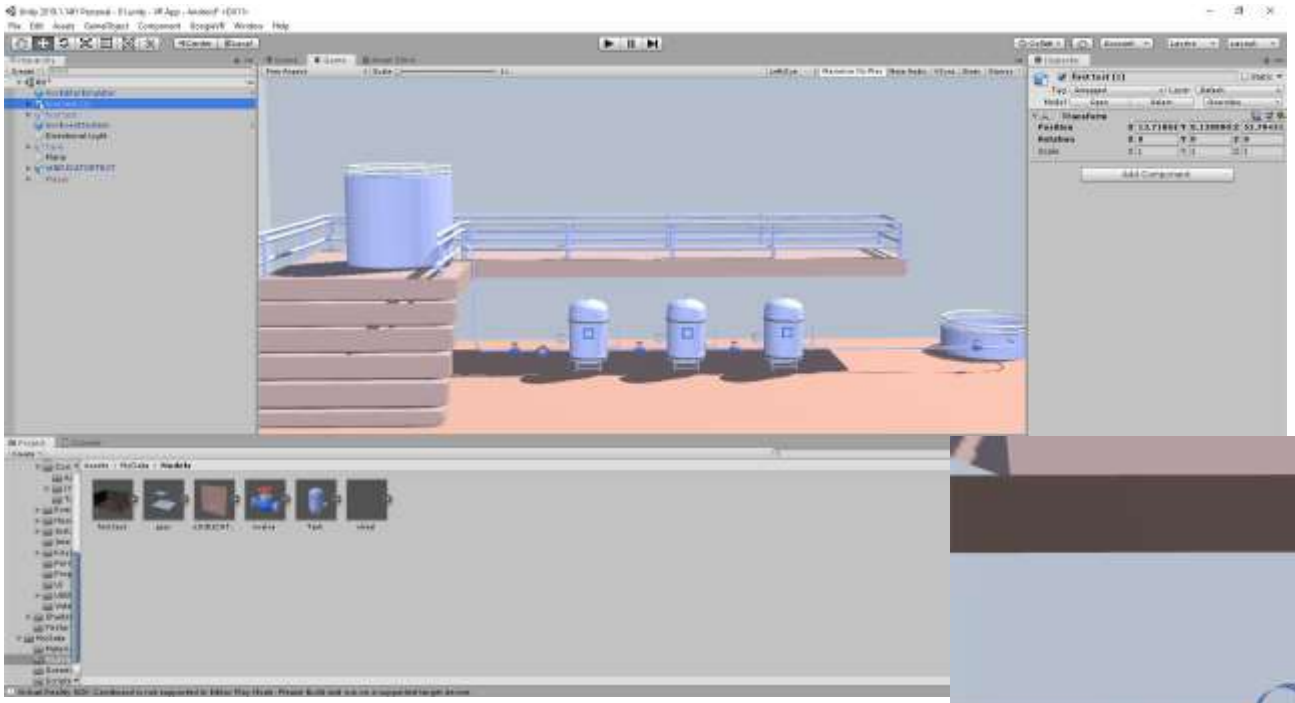


Collision detection in Unity

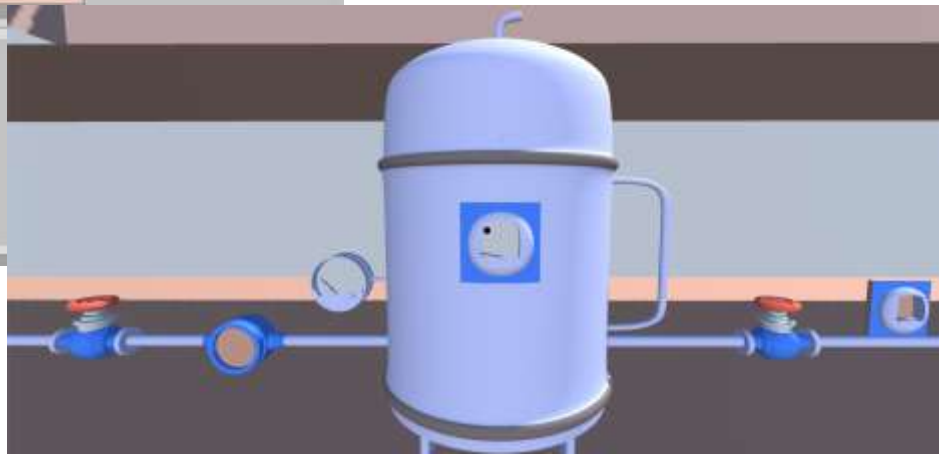
Courtesy of Volker Waurich - TU Dresden

Integration with Unity 3D Visualization in VAL – Virtual Automation Lab

Development environment



VR Model – Unity 3D

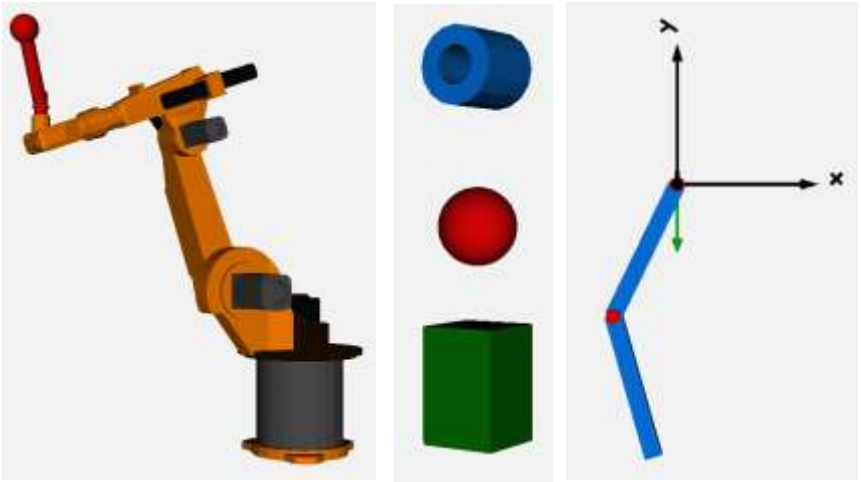


Developed by Modelicon and BMSCE in Bangalore, India

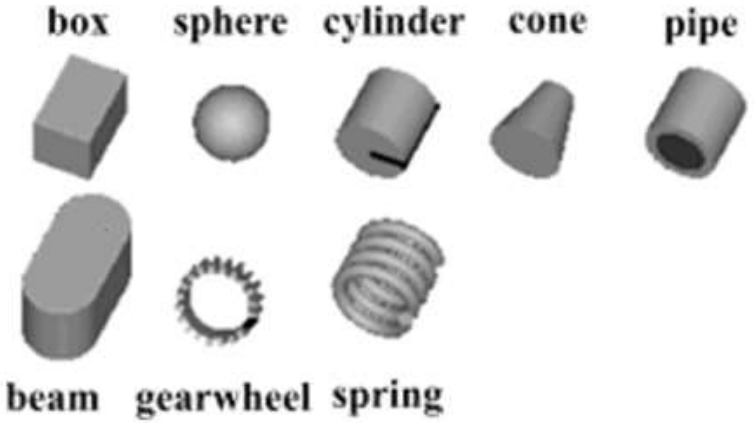
The Mechanics.MultiBody Library has Pre-defined Geometric Shapes

Default visualization shapes for
Body, BodyShape, BodyBox, and BodyCylinder

- Geometric primitives and CAD-Files:

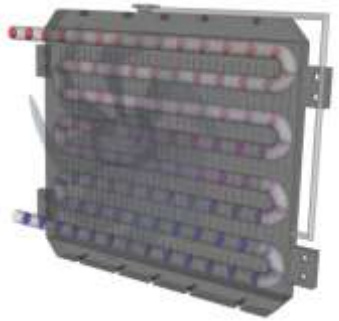


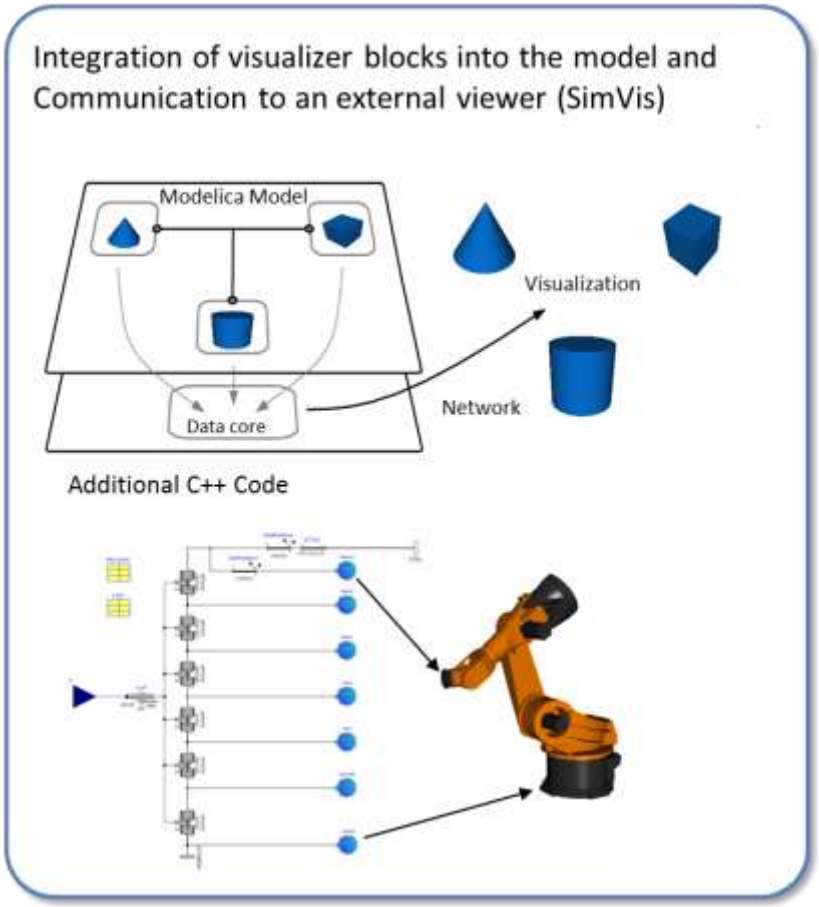
Visualization body shapes for BodyShape depending on the value of shapeType



Visualization using Third-Party Libraries: DLR Visualization Library

- Advanced, model-integrated and vendor-unspecific visualization tool for Modelica models
- Offline, online and real-time animation
- Video-export function
- Commercial library, feature reduced free Community Edition exists



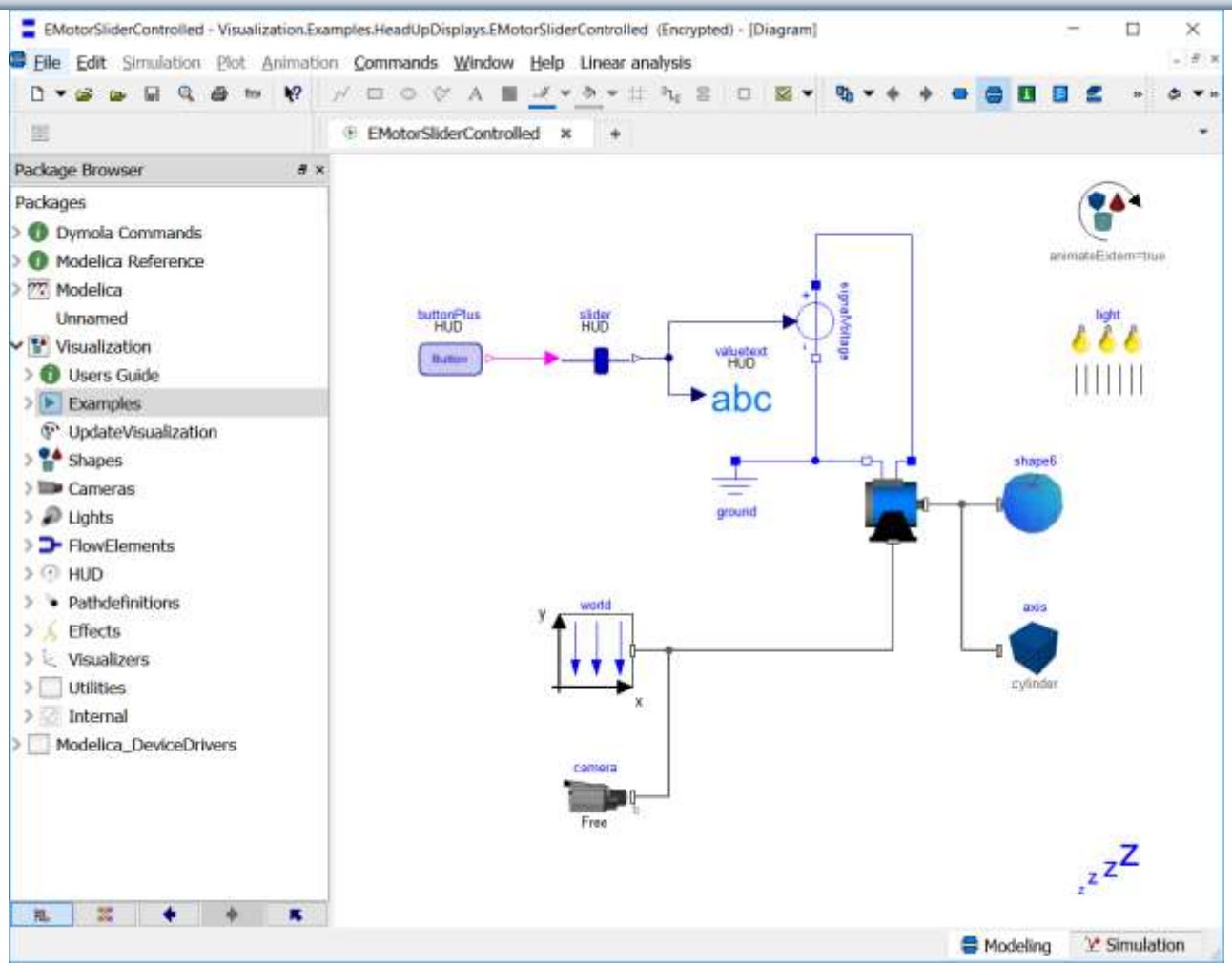


Courtesy of Dr. Tobias Bellmann (DLR)

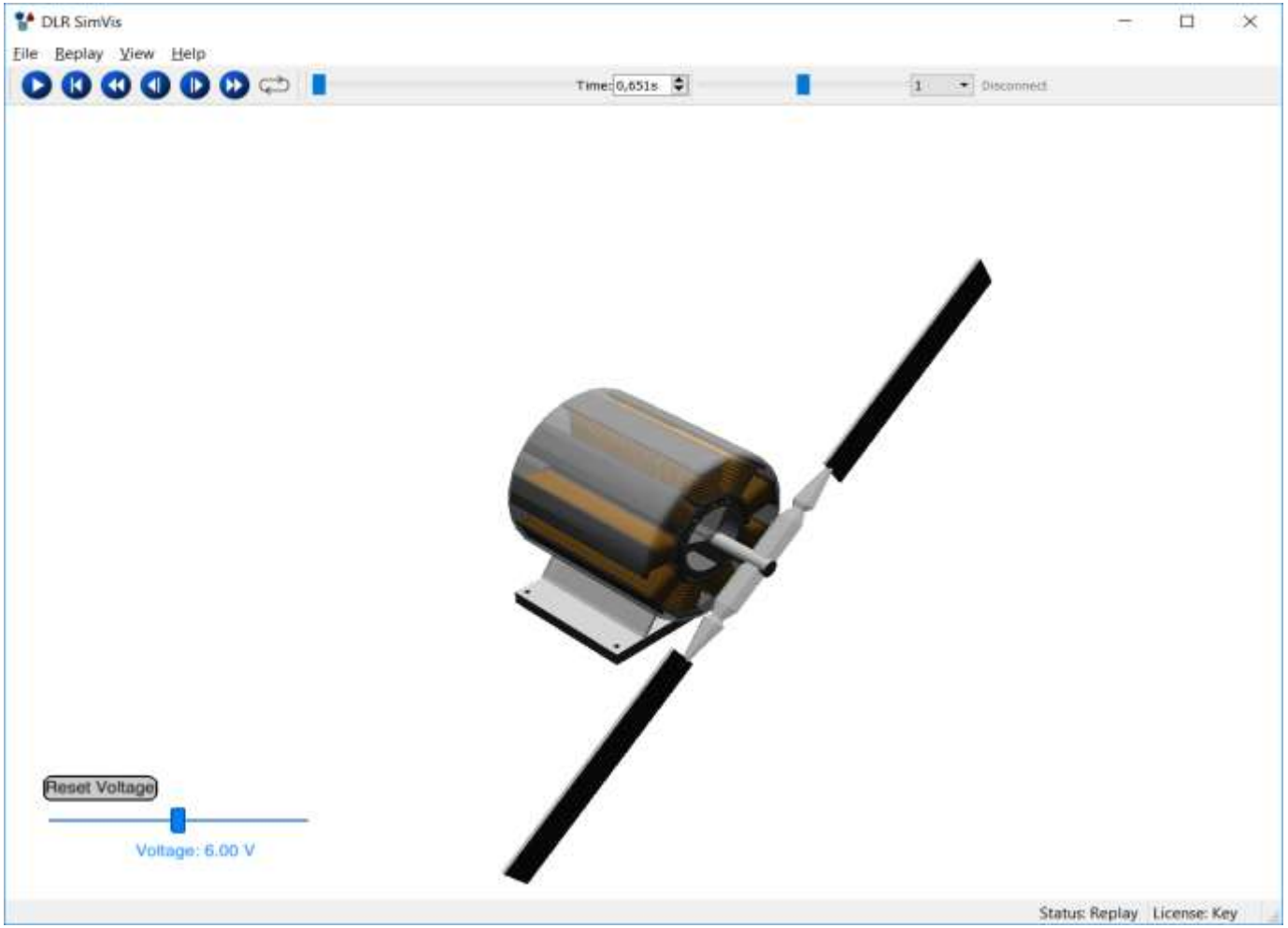
DLR Visualization Library – More Details

- Advanced, model-integrated and vendor-unspecific visualization tool for **Modelica** models. especially useful in the **mechanical**, **fluid** and **electrical** area. Most components are attached to a Modelica model with a **Frame connector** of the **Modelica.Mechanics.MultiBody** library
- Offline, online and real-time **animation**
- Visualizers for basic **shapes**, **CAD** files (.3ds, .obj, .dxf, .stl, .vrml and more), **flexible bodies** and surfaces, **text**, **light**, energy-/mass-flow visualizers, analogue instruments and weather effects. A **camera** system.
- **Buttons**, **Checkboxes** and **Sliders** are available for the creation of graphical user interfaces. **control** the simulation **interactively**.
- Support for **multi-camera scenes**, a **fullscreen** mode, several monitors, replays and stereo/wireframe modes. Based on the **OpenSceneGraph**
- **Video-export** as MPEG4, Windows Media Video, Flash Video

DLR Visualization Library – Modelica Components



DLR Visualization Library – DLR SimVis Viewer

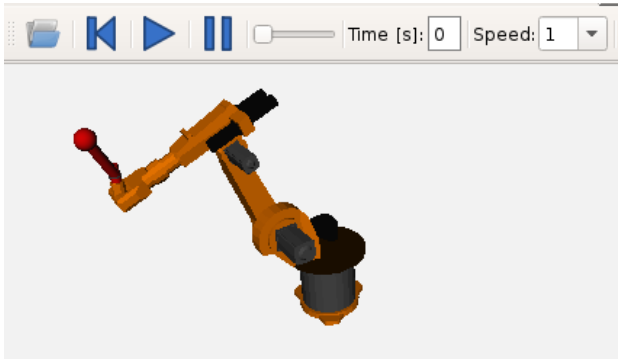


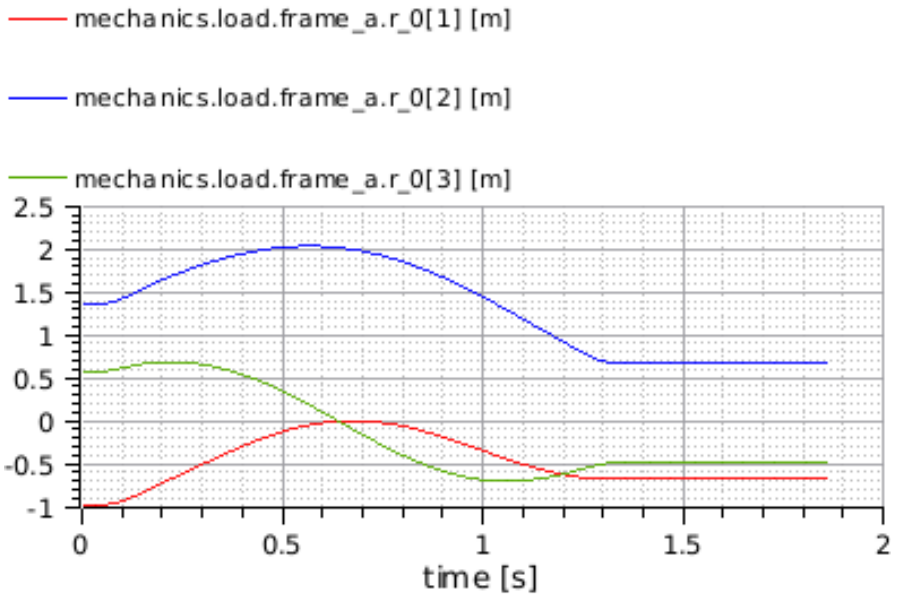
Example View

Exercise 4.1: Use 3D Visualization for Robot model

- Open the Modelica.Mechanics.MultiBody.Examples.Systems.RobotR3.fullRobot example in OMEdit

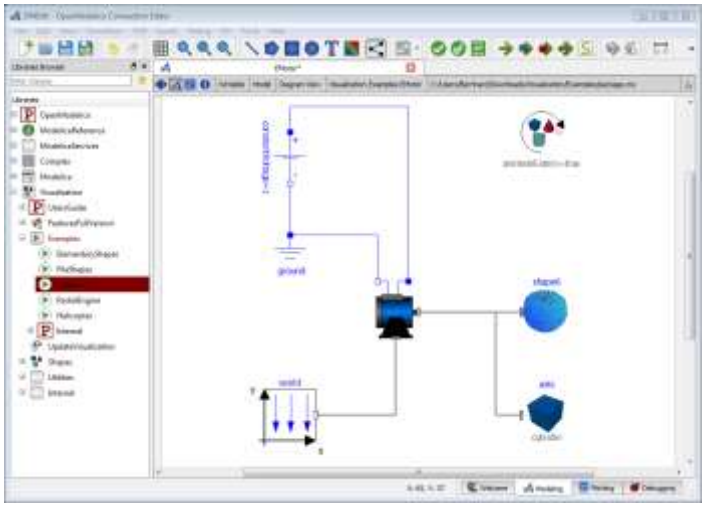
- Press Simulate with Animation
- Replay the animation
- Compare with the plot

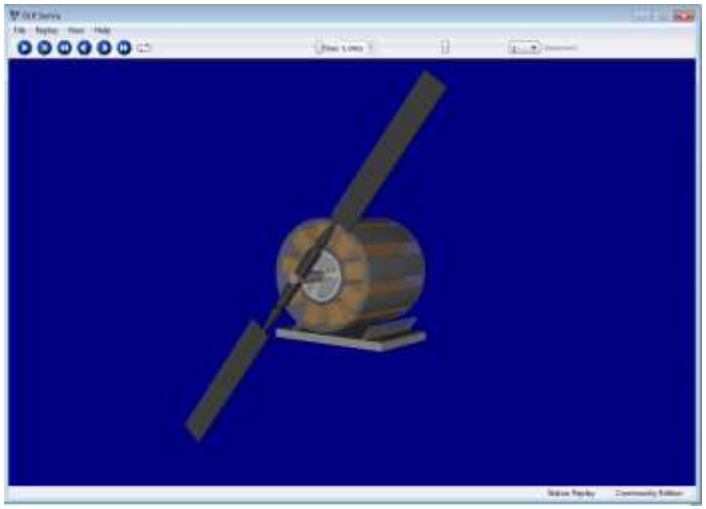




Exercise 4.2: Visualization using the DLR Visualization Community Edition (1)

- Unpack VisualizationCommunityEdition.zip
- Open the library in OMEdit, by doing load library on the Visualization subdirectory
- Simulate (not with animation) EMotor example
- The DLR SimVis visualization app should start automatically
- Export the animation (File→Export Replay as Video, use an absolute file path to find the created file)





Please note: As of OpenModelica v1.12 support for the library is only partial and it is not yet as stable, fast and complete as for the Dymola tool (work in progress!)

Exercise 4.2 Cont': Visualization using the DLR Visualization Community Edition (2)

Goal: Instead of OMEdit, use **OMShell** for running the examples

- Enter the Visualization directory in the accompanying files and use an editor to open the OpenModelica scripting file runVisualizationCommunityExamples.mos
- Change the "libraryPath" variable in the script to the respective library path on your machine
- Start the OMShell tool
- You can copy-paste the commands from the scripting file into the OMShell tool