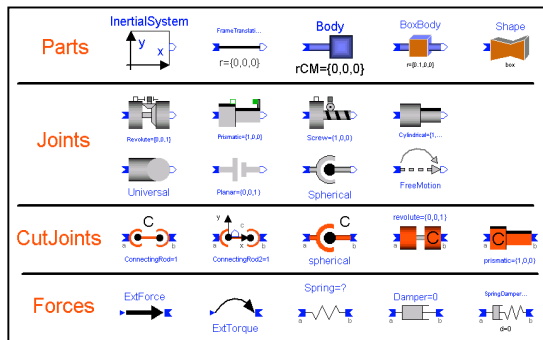


MultiBody Library

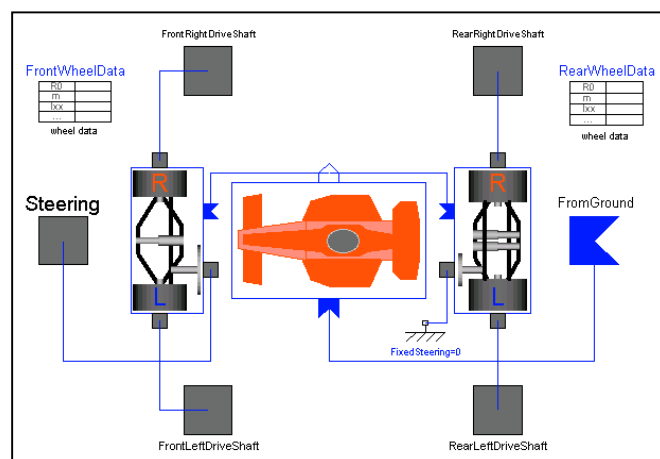


Partial list of MultiBody components

The free MultiBody library contains 3-dim. mechanical components to model rigid multi-body systems, such as robots, satellites, or vehicles. It efficiently solves the two standard problems:

- the *direct* problem to generate the equations of motion, i.e. differential equations in state space form.
- the *inverse* problem to calculate the generalized forces in the joints as function of the movement of the multi-body system.

A unique feature of the library is the property that joints can have a *variable* structure. That is, every degree of freedom of a joint can be *locked* and *unlocked* during movement without degenerating efficiency. Together with the free library Modelica.Mechanics for modeling of 1-dim. mechanical systems, this feature can be used to easily model brakes, clutches, stops or sticking friction. Together with the library an example model of a robot is provided, which has dry friction in all of its 6 joints. Due to sticking friction, this leads to $2^6 = 64$ possible configurations.



The library provides basic model classes for the modeling of rigid bodies, ideal joints, force and measurement elements. Bodies are connected by revolute, prismatic and other ideal joints. Kinematic loops can be handled by using cut-joints to break the loops.

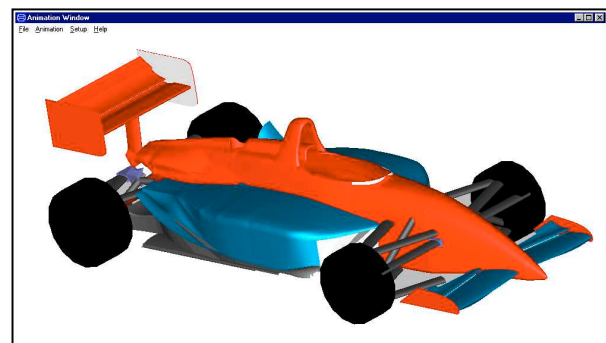
For a user it is easy to introduce new components or copy and modify existing ones. For example, force elements may be derived by inheritance from the superclass *LineForce*.

Main Elements of the MultiBody library

- *Inertial* system with definition of gravity.
- *Rigid translation and/or rotation of frames*.
- *Rigid bodies* (mass and inertia have to be provided or are computed from shape data).
- *Visualizers* for animation (different shapes, dxf-files for CAD-data, vector visualization).
- *Joints* (revolute, prismatic, spherical, ...)
- *Cut-Joints* (revolute, prismatic, spherical, two spherical joints connected by rod, ...)
- *3D-force/torque elements*
- *Force/torque elements along a line* (together with library Modelica.Mechanics).
- *Sensors* to measure kinematic quantities
- *Example models* to demonstrate the usage.

Author

The MultiBody library is designed, implemented and maintained by DLR, the German Aerospace Center, Institute of Robotics and Mechatronics, Oberpfaffenhofen,



Example system built-up with MultiBody library: Real-time model of 3-dim. vehicle dynamics of Dallara racing car.