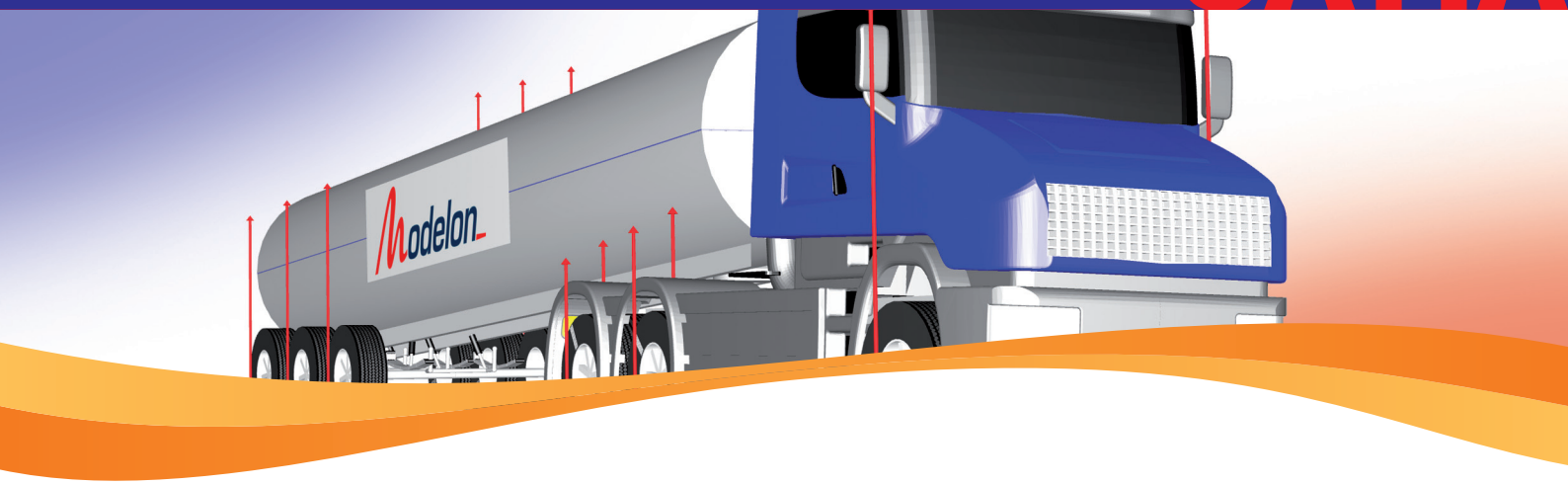


# DYMOLA – Vehicle Dynamics Library Trucks

## Overview

- **Modeling, simulation, and analysis of dynamics of heavy vehicles**

## Key Features

- **Axles and bogies**
- **Couplings**
- **Loads**
- **Twin tires**
- **Leaf springs**
- **Templates**

## Benefits

- **Reduced workload and increased development pace with ability to develop and test for all vehicle variants and conceptual designs systematically**
- **Ability to select the right representation both for conceptual tests and detailed studies thanks to different levels of detail**

*Truck-trailer combination with a closed loop driver model negotiating a double lane change.*

The VDL Trucks Library provides designers of heavy vehicles with a purpose built environment for the modeling and simulation of heavy vehicles. VDL has established a new benchmark for the simulation of ground vehicles, allowing the precise description of the subsystems, components and control attributes. The resulting simulation provides a complete analysis of the vehicle dynamic characteristics. A major benefit of the Dymola ® environment is the readily available capability for the description and archiving of components and subsystems, this facilitates the rapid and accurate modeling and simulation of many types of vehicle architecture. The VDL Trucks Library contains a wide variety of heavy vehicle components and subsystems.

### > Convenient reconfiguration

Templates are provided for standard configurations, which allow for easy reconfiguration of a vehicle system. These templates may be easily modified to represent more specific needs. This may include, for example, extending number of axles and trailers. Many standard test scenarios are also predefined, this allows for convenient determination of both steady-state and transient characteristics.

### > Suspensions

The library contains many components that are specific to heavy vehicles, including axles, twin tires, couplings, frames, and cabins. The suspension designs in heavy vehicles are commonly axle-based for the steerable and non-steerable wheels. Leaf springs are commonly used for both axle guidance and load support. The constituent models may account for the nonlinear kinematic effects.
Suspension load characteristics vary from linear to tabular or physical models such as air springs. The frame elasticity influences the load distribution between the axles and thus the available grip from the tires.

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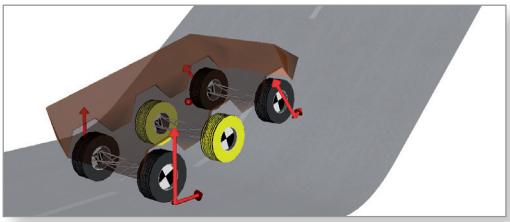
### > Frames and loads

The elastic frame included in VDL trucks has a torsional degree of freedom that may be extended by more detailed models if required. The payloads may be static (e.g. a crane), dynamic (e.g. a tank for liquid load) or have varying masses or mass distributions (e.g. cargo containers). All load cases are supported with a user-friendly configuration setup. The existing liquid payload model considers the dimensions of the tank and a rotational damped degree of freedom for slosh. The cabin may be rigidly mounted or connected using dedicated suspensions.



*Six-wheeled all terrain vehicle with wheel load distribution control performing a hill climb test.*

### > Custom Vehicles

The Trucks library benefits from the extensive flexibility of VDL. Templates and components are easily modified to fit custom needs. The number of trailers can be extended to describe longer vehicle combinations. It is also straight-forward to build other types of vehicles, such as articulated wheel loaders and all-terrain vehicles. Both hybrid and conventional drivelines may be included in any configuration, both in terms ofthe axles that are driven, and torque distribution functions such as differential lock.

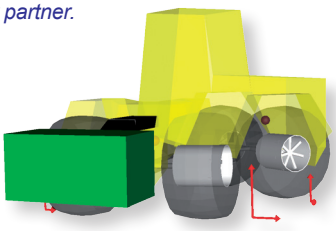
### > Active Systems

Active components may be introduced at any location. This, for example, can be adjustable air springs, or a steerable tag axle. Benefiting from the true multi-domain capabilities, these components may be modeled in detail if required, for example with dedicated electrical, pneumatic or hydraulic components available from other Dymola libraries. In combination with the seamless integration with other platforms, such as Simulink™, this highlights Dymola and the VDL Trucks Library as the complete simulation platform for model-based development process.

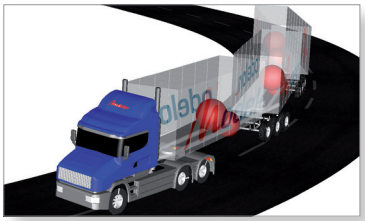
### > Experiment setup

Simulation experiments for passenger cars and heavy vehicles have many similarities and correspondingly share setup of drivers, roads and environment. As for cars, road/vehicle interaction studies can be done with driver or robot control the vehicle on 3D-roads or open surfaces. Driver models look ahead along the road to control the positioning of the vehicle, and may work on a time basis as, for example, if following a drive cycle or sequence of instructions. Robots are used with chassis and vehicles on flat ground and control the motion in either open-loop or closed-loop based on vehicle states. Test rigs are used to isolate vehicle or subsystem behavior, typical examples are the kinematic and compliance characteristics analysis of suspensions or force-slip characteristics of tires.

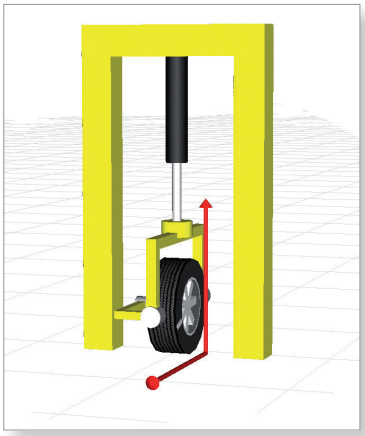
*The VDL Trucks Library is developed, supported, and maintained by Modelon AB, a Dassault Systèmes technology partner.*



*Articulated wheel loader in jack-knife stability test.*



*Road train configuration with three semi-trailers in curve stability test with closed loop driver model on 3D road.*



*Wheel model in test rig for automatic slip-force characteristics generation.*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