

VPG Solutions Using MotionView®

Michael White
Altair Engineering

Abstract

The MotionView® product has been extended in version 6.0 to support LS-DYNA input and output. MotionView is a template based pre and post processor with a long history in the automotive industry. An example of an automotive handling event, and several examples of durability events will be shown. A vehicle model with a complete powertrain (engine and transmission) will be simulated, to demonstrate the “plug and play” templated model methods used by MotionView.

The Altair Swingset benchmark problem will be run in LS-DYNA, and the results of this will be shown, to illustrate a consumer products application of the tool.

Introduction

MotionView is a general Multi Body Dynamics pre and post processor that has been widely used in the automotive industry to analyze full vehicles and suspension systems using the ADAMS® solver. MotionView uses a library based system of model and event templates to quickly build complete vehicle models. The use of library based models also ensures the user that the modeling methods are consistent and robust. The full vehicle model shown in this paper was assembled using the standard MotionView libraries. The libraries can also be customized to include special events and modeling preferences that individuals or companies wish to include as part of their standard analysis process.

The swing set example shown in this paper was built using the MotionView interface. Systems that are not modeled in the library can be built graphically using the interface. Library models can also be modified using the interface.

Version 6.0 of MotionView allows the user to export the model to a variety of solvers including LS-DYNA®. Custom writers can be developed to interface to proprietary or academic solvers.

Vehicle Model

The vehicle model, shown in figure 1, represents a typical pickup truck chassis that is sold in the United States. The front suspension is a “short-long arm” or “double wishbone” suspension. The steering system is a rack and pinion with universal joints connecting the rack to the steering column. The rear suspension is a five link solid axle style suspension. The powertrain is a longitudinal engine with a driveshaft connecting the engine to the rear axle. The body and the chassis are represented as rigid bodies in this example. The systems incorporate a variety of joints to connect them, including flexible bushings and kinematic joints. The subsystems are illustrated in figures 2-4.

The tire is represented by a linear spring. Road profiles for this analysis were built in Hypermesh® and exported into a template that was included in the model using the MotionView interface.

Figure 1-Vehicle Model

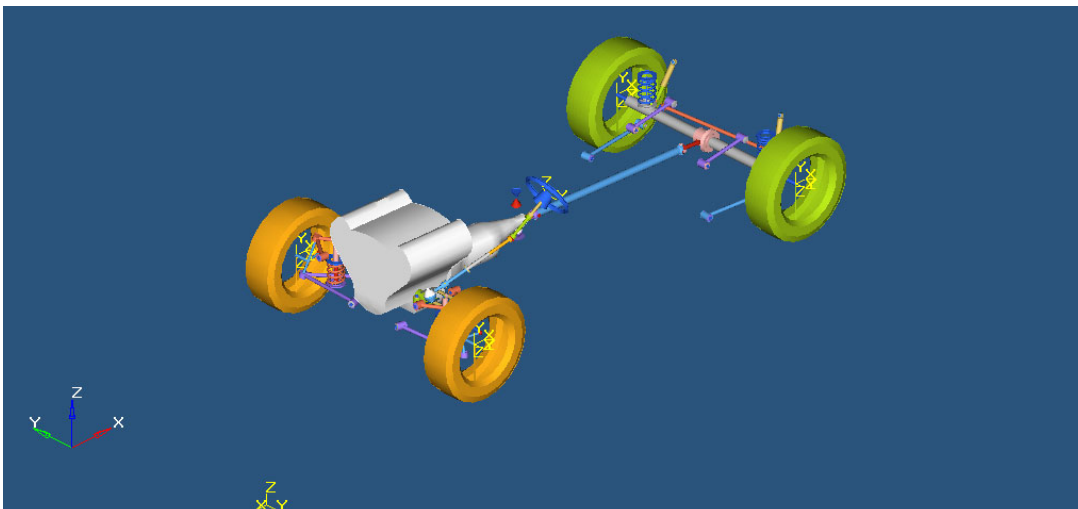


Figure 2-Front Suspension

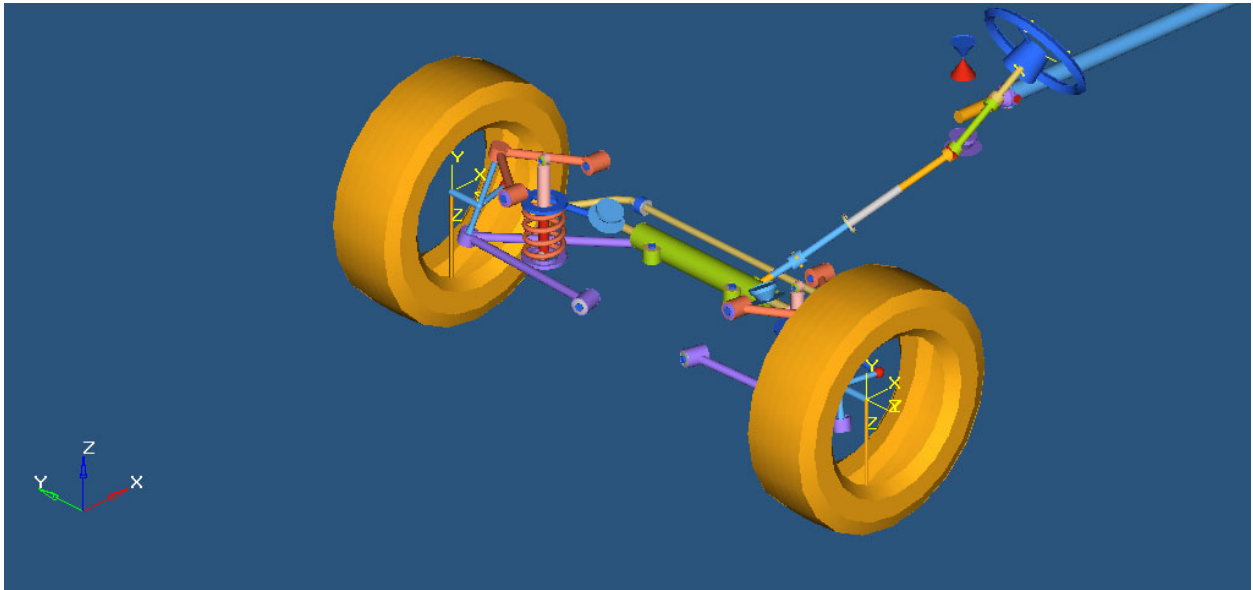


Figure 3-Rear Suspension

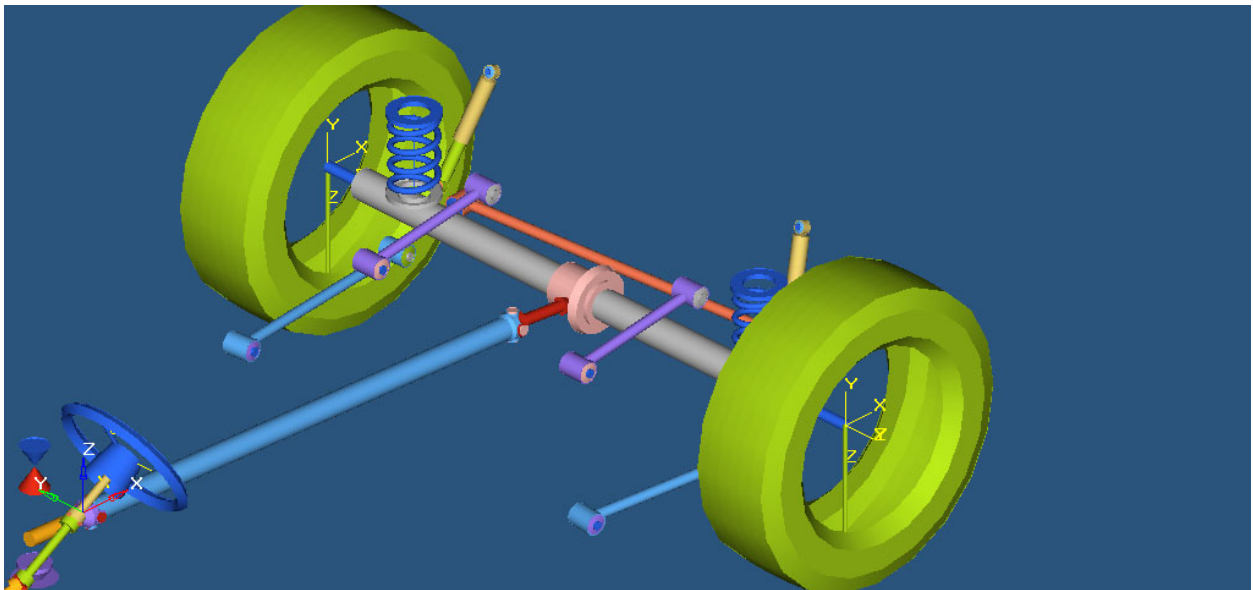
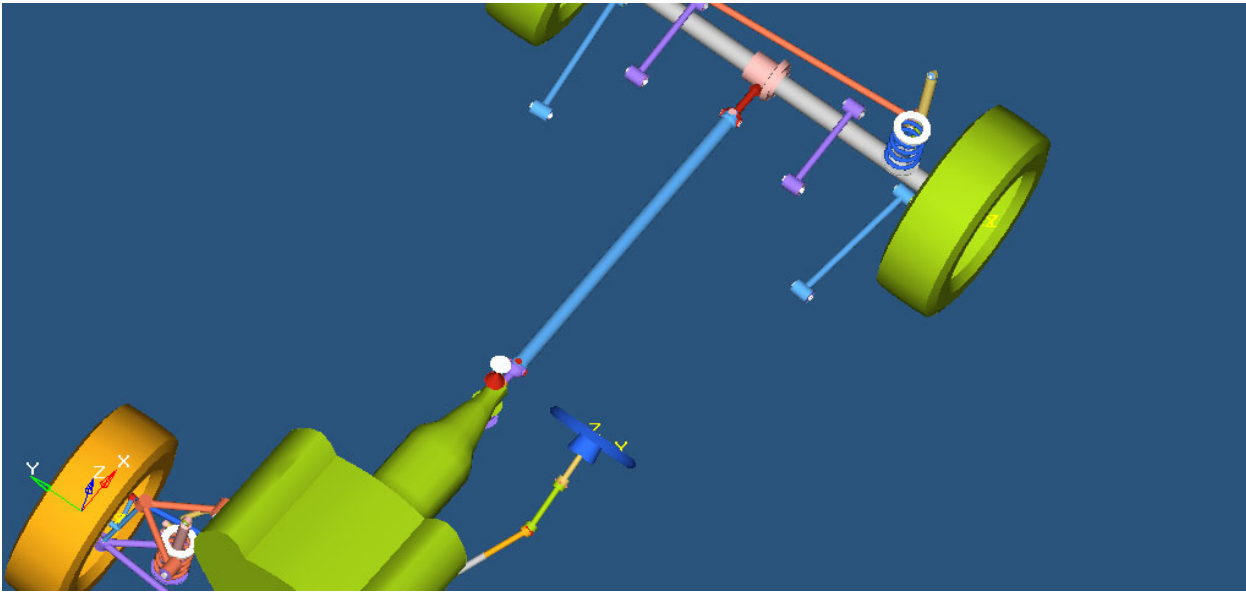


Figure 4-Powertrain



Simulation Description

The vehicle was run through a 4" square edged pothole, which represents a typical durability event run by automotive manufacturers. Initial speed of the vehicle was 30 MPH. The speed was not controlled during the event, so the vehicle "coasts" through the pothole. The model results will be animated during the presentation at the LS-DYNA conference.

Swingset Model

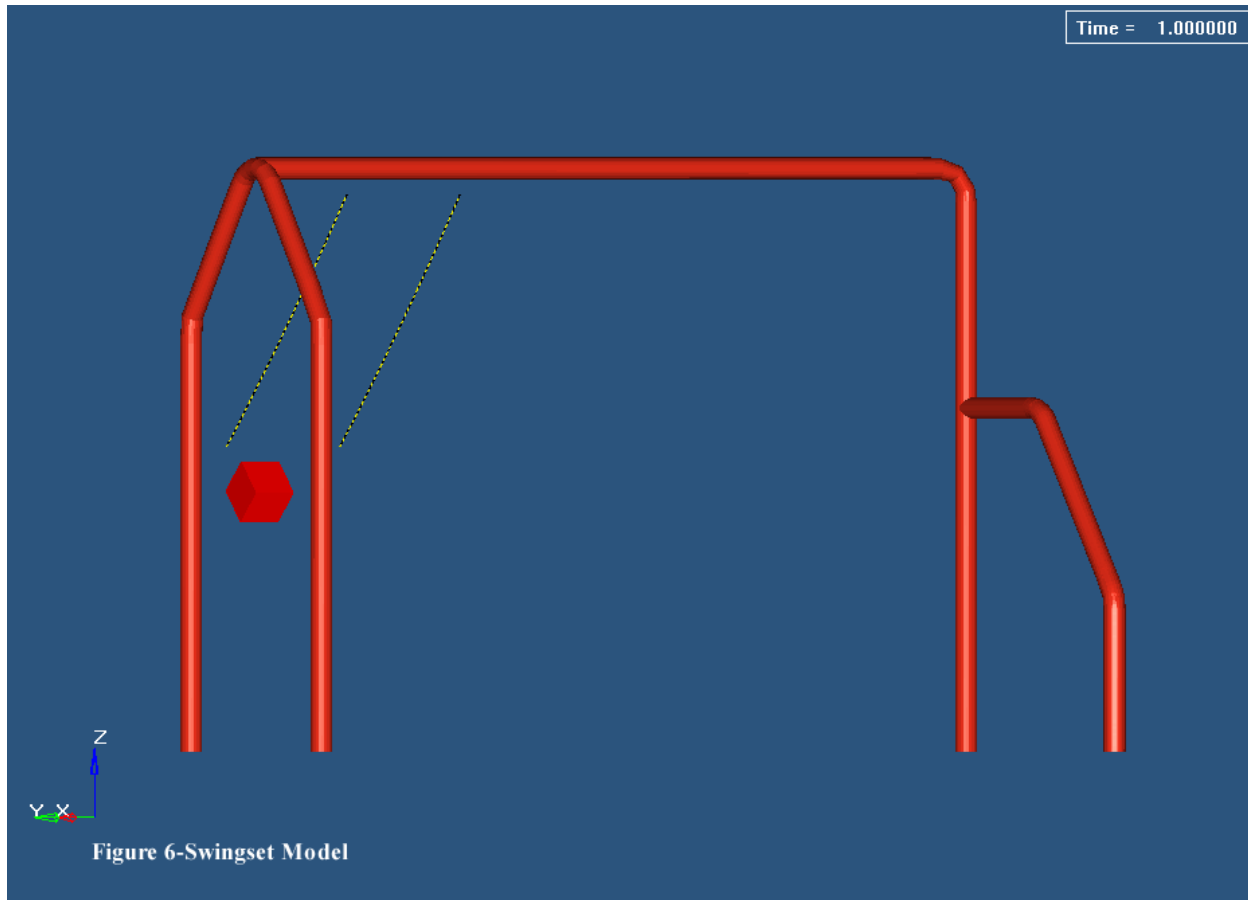
The Swingset model is a simulation of a children's swing set as shown in figure 5. The model was originally shown in the 2003 MSC User's conference (reference 1). The model is shown in figure 6. The swingset structure is assumed to be infinitely stiff, and the chain is modeled as a series of joints and rigid bodies. The child is also modeled as a lumped mass rigid body. The swing is pulled back and then allowed to swing freely. The model is used at Altair to check Multi Body solvers for performance when simulating models with a large number of lumped masses.

Figure 5-Child's Swingset



Swingset Results

The swingset model runs in LS-DYNA and results are similar to those obtained from other solvers. The shape of the chain in the side view shows the characteristic curvature, which is caused by the inertia of the chain links. The period of the swing is also the same as both test data and ADAMS simulation results. Animations of the swingset will be shown at the LS-DYNA User's conference.



Conclusions

MotionView 6.0 allows easy model assembly of vehicle models and easy simulation using the LS-DYNA solver. Models can be built from the supplied libraries or can be built using the Graphical interface. Dynamic events can be successfully simulated and correlate well to other MBD codes and to test results. Further information on MotionView is available on the Altair website (www.altair.com) or by contacting the author at maw@altair.com

References

Burford, Davis & White. Video Correlation and Verification of MSC-ADAMS Models. 2003 MSC North American User's Conference.