CarMaker Tips & Tricks No. 2-007 How to integrate a user-defined model of Elastic Cab mounts in TruckMaker?



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Integrating a user-defined model of Elastic Cab Mounts in TruckMaker

This is a guide on integrating a user-defined Simulink model for elastic cab mounts in TruckMaker. This example focuses primarily on the approach of using Simulink Coder (formerly RTW) to generate a Plugin from the customized model, which is then linked with the source code to build a custom CarMaker executable.

Technical Background

TruckMaker simulations which focus on driving comfort might require the consideration of elastic cab mounts for more accurate analyses. In addition to generic models for simulating such a flexible mount, TruckMaker also provides a DVA-based interface for integrating a user-model available in Simulink.

Solution

Step 1: Generating a Simulink Plugin begins with choosing the right model wrapper. As the Elastic Cab Mounts do not have a wrapper class of their own, the Generic Plugin Model approach is used.



Figure 1: User-defined Model as Generic Plugin



In the Simulink model window that opens, the user-defined model is included. The elastic cab mount forces are written to the corresponding UAQs using the *Write CM Dict* blocks. (Figure 1 shows a simplified representation where constants are assigned). If required, *Read CM Dict* are used to read UAQs that are required as inputs for the user-defined cab mount model.

Detailed information on the UAQs of the elastic cab mounts are found in the TruckMaker Reference Manual.

Once the model is complete, Simulink Coder is used to compile it as a C-code library and further linked to generate a CarMaker custom executable in *src_tm* folder. This is selected in Application Configuration. The compile info shows the Plugin library among the linked libraries.

TruckMaker - Application Configuration				
Application	Configuration	Close		
Project Folder: /fs	/u3/SolutionsEngineering/TestUmgebung/work.chv/01 TruckMaker/TM 80	Start		
Command (executable)				
src_tm/TruckMaker	linux64 🚽 😑	Connect		
Command line opt	ions			
	•	Disconnect		
Application Status	Compile Info			
Options				
-03 -DNDEBUG - -l/fs/opt/ipg/carma	DLINUX -DLINUX64 -D_GNU_SOURCE -D_FILE_OFFSET_BITS=64 -DCM_NUMVER .ker/linux64-8.0/include -m64 -fPIC -Wall -Wimplicit -Wmissing-prototypes	=80000		
Libraries				
libCabDVA_linux6 libtruck.a libcarmaker.a libipgdriver.a libipgroad.a libipgtire.a	i4.a CabDVA linux64 1.0 2019-05-31 CarMaker-Truck linux64 8.0 2019-04-15 CarMaker linux64 8.0 2019-04-15 IPGDriver linux64 8.0 2019-04-03 IPGRoad linux64 8.0 2019-04-08 IPGTire linux64 7.1 2018-09-13			
Compiled by: ml@	@wslinux-appl009.ipg_2019-05-31 16:06:18			

Figure 2: Application Configuration



Step 2: After compilation and selection of executable, the Vehicle Data Set has to be parametrized. To enable the user-defined model, the Mode of the Forces are set to DVA.

- *DVA*: The desired force element force is set using the Direct Variable Access on the quantities:
 - GenFrc: Car.Cab.GenFrc.[x,y,z], Car.Cab.GenTrq.[x,y]
 - 3xFrc ... 5xFrc: Car.Cab.Frc.[0..4].Frc.[x,y,z] For the static equilibrium the forces are calculated with the model kind Coeff.

TruckMaker - Vehicle Data Set: Demo2AxleSemiTruck4x2_Actros								
Vehicle Data Set	t						File 🔻	Close
		00	0	00	00 00			
Vehicle Body Bodies	Cab Mount	Platform Mount	Axles	Steering	Tires Brake	Powertrain	Aerodynamics	Ser} 🕨
Elastically mounted	Driving Cab			· ·			1	
General	x [m]	y [m] z	: [m]	Mass (kg)	lxx [kgm²]	lyy [kgm²]	Izz (kgm²) 🔹 🕨	
Body Cab	4.5	0.0	1.75	1000.0	300.0	300.0	2000.0	
Origin FrCab	5.0	0.0	1.0				_	
Mounting: ± 3 expl	icit Force Ele	ments					🗔 Graphic	
Position X - Y - Z [m] Force X Force Y For Mode: DVA Stiffness [N/m]	ce Z	4.5	0.0	1.0 Bo Damping (Na	dy Mounting:		r1A	
Compress [m] Forc [l] 0.0 0 0.01 1000 0.1 10000	e 10000 10000 8000 6000 4000 2000 -0.04 -0.04 -2000	Force [N]	sion [m] 0.09	Velocity [m/s] -0.1 0.0 0.1	Force [N] -200.0 0.0 100.0	-0.08 -0.04 -1	100 Force [N]	1
Amplification [-]		1.0 0.2		Amplification	י [-]	1.0)	

Figure 3: Vehicle Data Set Parameterization



Step 3: The point of DVA is set as an additional parameter. The optional parameters for a Generic Plugin are found in the Programmer's Guide.

™ TruckMaker - Vehicle Data Set: Demo2AxleSemiTruck4x2_Actros									
Vehicle Data Set		Close							
 unt Platform Mount Axles Steering Time + 	es Brake Powertrain Aerodynamics Sensors Vehicle Co Movie Geometry 3D/Vehicles/MB_Actros_1996.mobj Vehicle Graphics MB_Actros_1996.png Vehicle Outer Skin x [m] y [m] z [n Rear lower left point 0.0 1.25 Front upper right point 6.0 -1.25 Hitch System Semi trailer hitch	ntrol Misc. Misc. Misc. 1 0.8 3.5							
Description Typical, unvalidated data for 2-axle semi truck 4x2 with 1/2/3-axle semi trailer Tire: RT_315_70R22 engine power 353.0 kW (480 PS) at 1900.0 rpm max. torque 2250.0 Nm at 1100.0 rpm length x width x height 5260.0 mm x 2480.0 mm x 3764.0 mm wheel base 3600.0 mm Additional Parameters									
GenericPlugin.CabDVA.AbsPlace = IO_I									

Figure 4: Additional Parameters for Generic Plugin

Disclaimer:

The example does not list all the steps in using MATLAB/Simulink for Plugin generation. Also, the user should be familiar with the basic features of TruckMaker such as Direct Variable Access (DVA) and User Accessible Quantities (UAQs). Detailed information on these are found in the TruckMaker Documentation.