

03MIQ – Automotive Control Systems

Simulation (Carsim-Simulink) laboratory instructions

Some general notes on using CarSim 2019.0 and Matlab/Simulink R2020a

1. Some useful information can be obtained from CarSim Help menu and submenus:
 - a) Quick Start Guide manual (submenu Guides and Tutorials, also on exercise.polito.it);
 - b) Vehicle Dynamics Terminology (submenu Technical Memos) for the reference systems and variables definition;
 - c) Import and Export Variables (submenu Model Extensions and RT) on how to add output and input variables to a simulation.
2. **IMPORTANT!** Before modifying the selected pre-defined *Dataset*, to preserve the original one, do the following:
 - from menu *File* select *New Dataset Plus All Linked Datasets...*
 - set the *Category* name (the personal one you like, for example *ACS Lab* or *your name*) and save.
3. **IMPORTANT!** A modified *Dataset* can be saved and restored by the commands:
 - from menu *File* select *Export Consolidated Parsfile*
 - from menu *File* select *Import Parsfile*
4. To use your own Simulink scheme in CarSim, select a Simulink Dataset in CarSim, then on the main page in section *Run Control with Simulink* click on the light blue tab (e.g. *ABS Controller* for Lab #2), then, in the top right part of page that opens, set the path and file name of your scheme in the field *Simulink Model*.

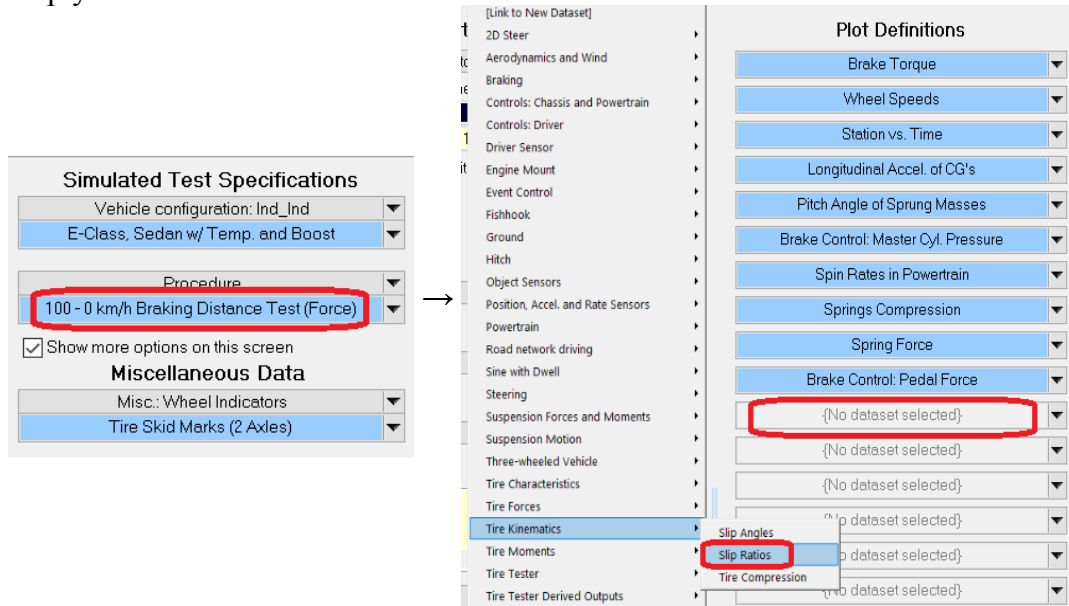
Correspondence between Kiencke Nielsen book variables and CarSim variables

Definition	KN	CarSim	Unit	Lab #
Wheels subscript	FL, FR, RL, RR	L1, R1, L2, R2	-	all
Wheels longitudinal slip	$s_{L,ij}$	Kappa_ij	-	1.2
Wheels velocity	$v_{R,ij}$	Vx_ij	km/h	1.2
Wheels angular acceleration	$\dot{\omega}_{ij}$	AAy_ij	rad/s ²	1.2, 2.2, 2.3
Vehicle side slip angle	β	Beta	deg	3.1, 3.3
Yaw rate	$\dot{\psi}$	AVz	deg/s	3.2, 3.3
Vehicle velocity components	v_{CoG}	Vx , Vy	km/h	3.1, 3.2, 3.3
Acceleration components	\dot{v}_{CoG}	Ax_SM , Ay_SM	g	3.2, 3.3
Tire side slip angle	α_{ij}	Alpha_ij	deg	

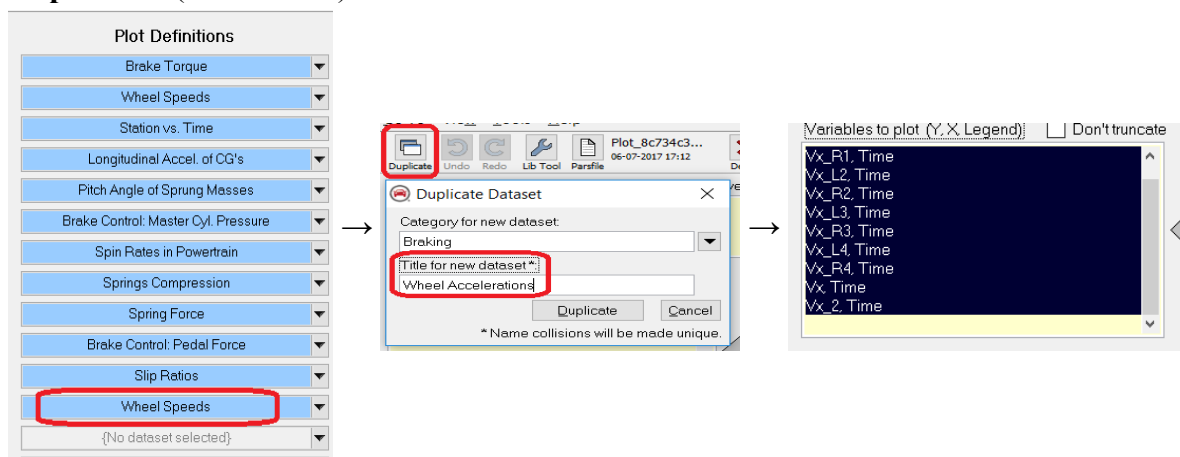
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Lab 1.*

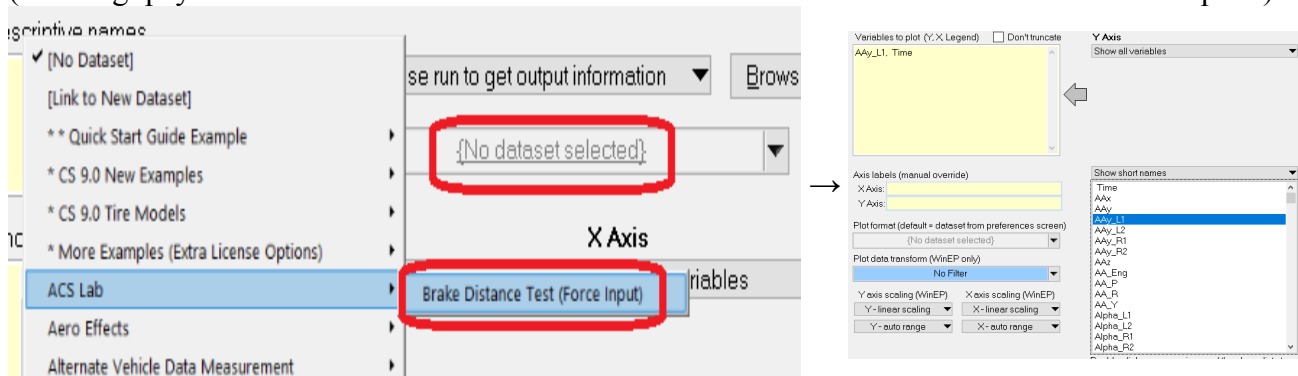
To add a plot: click on *Procedure* blue item in the main page → Under column *Plot Definitions* select an empty item and look for the needed variable.



If you are not able to find the needed variable, you can follow the previous procedure selecting a “similar” variable (e.g. Wheel Speeds for Wheel Accelerations), then click on the added blue item → **Duplicate** it (use the icon) with a new “Title” → Erase the current variables.



Select the Dataset you are working on (if needed) → Add the needed variables from the list “Y Axis” (Warning: pay attention to the variables order that must be coherent with the one in the other plots).

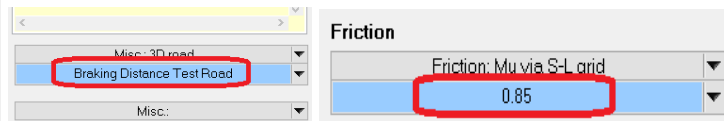
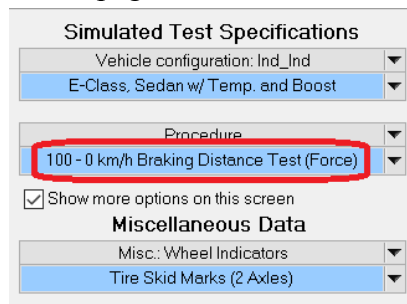


Note that to see the variables correctly plotted you could need to “Run” again the model from the main page.

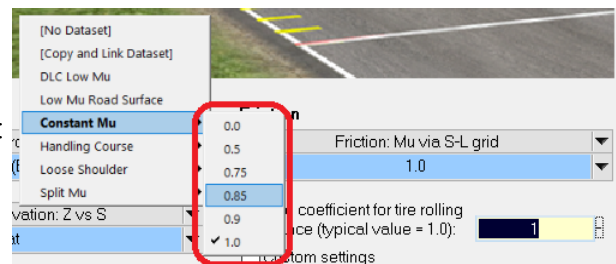
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To read a numerical value from plots: right click on the plot, select *Show all Data Channel value in legend*, then scroll the Time bar at the bottom.

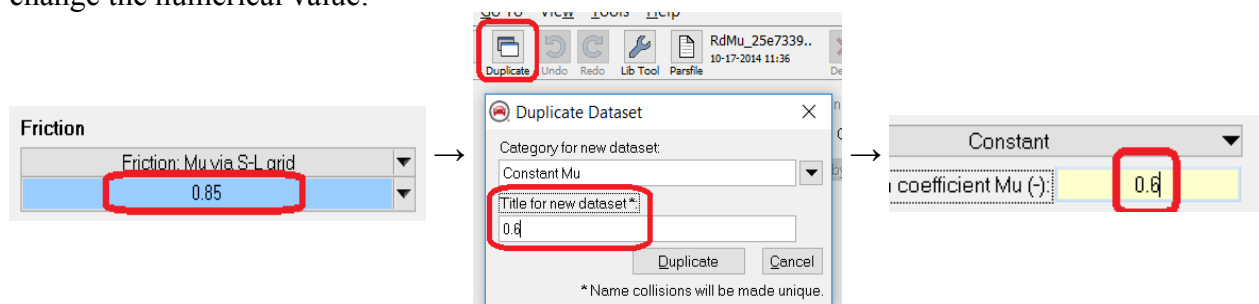
To change a numerical value of a parameter (road friction, for example): look for the parameter in the model pages.



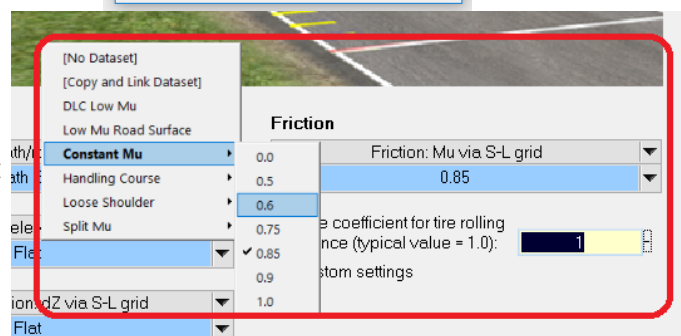
Then you can select one of the already existing values:



or define a new one by clicking on the blue item → **duplicate** it (use the icon) with a new “Title” → change the numerical value:



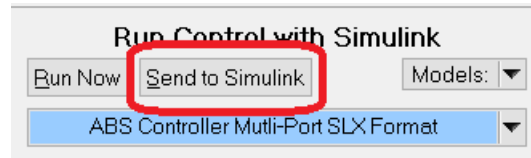
so you will find it in the list:



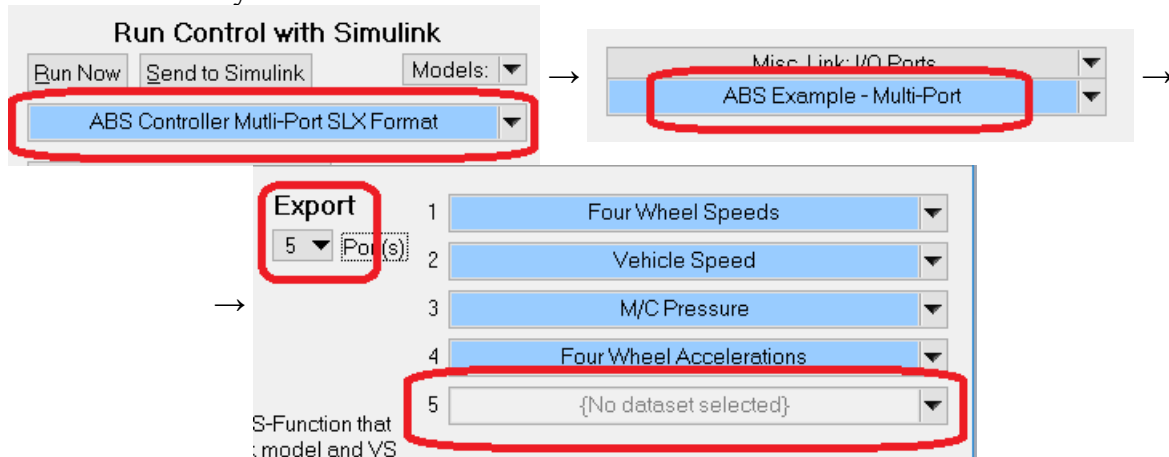
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Lab 2.* and 3.*

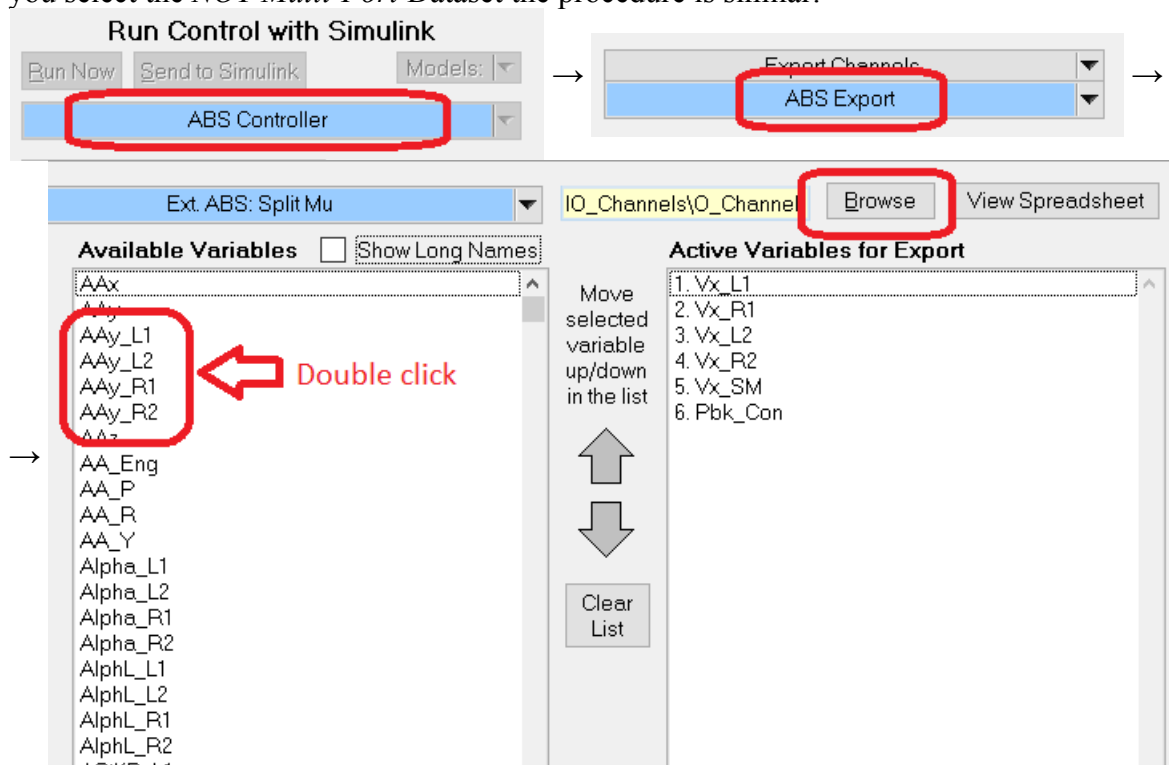
To view and simulate a CarSim model in Simulink: click on *Send to Simulink* in the main page and a Simulink window will open (wait! It could take a lot of time). If errors are got, try a 2nd time, or execute Matlab by itself.



To add a variable as CarSim block output: click on *Run Control with Simulink* blue item in the main page, then click on *Miscellaneous: I/O Ports* blue item, then increase the number of Export and select the needed variable as already done for Lab #1 and #2.



In case you select the *NOT Multi-Port* Dataset the procedure is similar:



After that click again on *Send to Simulink* and update coherently the Simulink scheme.