principal motion of the car, x_p, is separated from the other states and u_p is introduced for the corresponding inputs. A set of residual flow variables, R_p, is introduced to match the principal states and then $u_p$is used to minimize R_p. To the tool, this is presented as

$$G\big(p,(u',x_p),(x',u_p),(\dot{x}',\dot{u}_p)\big)=0,$$

where principal states now are inputs and principal inputs now are states. The structure of this formulation makes it straight-forward for the tool to transform it into

$$(\dot{x}',\dot{u}_p)=g\big(p,(u',x_p),(x',u_p)\big),$$

which can be solved with standard integrators. From this simulation one can gain knowledge of all the resulting vehicle states as well as the required driver input. At any point in time, R_p, will give a measure on the validity of the solution. Figure 12 shows the result from a quasi steady-state analysis. The car is set-up at a defined point along the race track, in this case a corner. The speed is increased while cornering curvature is maintained until the lateral acceleration capabilities are exceeded. The screen shots shows the car at different stages of this test.

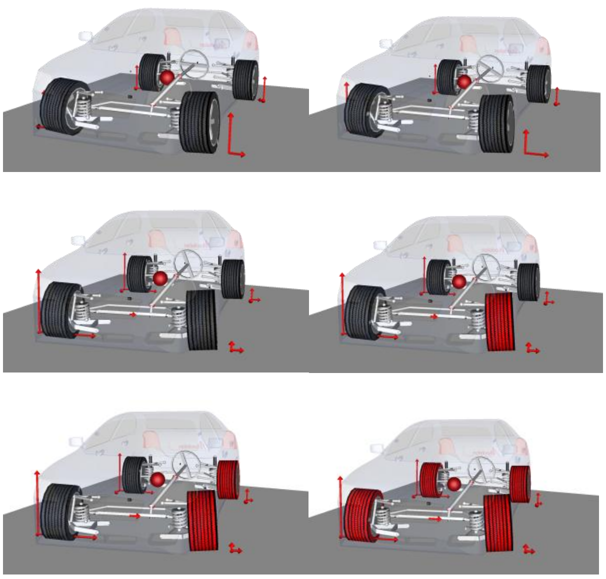

Figure 12 Steady state corner exit solutions for 10, 50, 90, 95, 98, and 100 percent of the car's capacity. Red wheel color indicates saturation. Arrows indicate tire forces. Note the change in steering wheel angle.

Summary

This paper highlights new features in VDL with emphasis on improved interoperability with other tools, improved simulation performance, and an expanded range of analysis.

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