

Development of New Concept Vehicles Using Modelica and Expectation to Modelica from Automotive Industries

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To cope with future mobility society, development of many new concept vehicles is becoming increasingly active in recent years [1]. Those vehicles have characteristics of smaller size, lighter weight, less number of passengers than the conventional vehicles. Also those vehicles tend to be equipped with lower RRC (Rolling Resistance Coefficients) tires and new driving systems mainly using electric motors to achieve less emission and less energy consumption. Some of those future vehicles are equipped with IWM (In-Wheel-Motor) systems to achieve flexible layout of power-train and also advanced vehicle motion control [2]. Because such new-concept vehicles have different mechanical structure and control structure from those of conventional cars, it was necessary to make new models to estimate their motions by simulation. In this paper, development of the simulation models of those new vehicles by Modelica is described. Those models were developed based on Vehicle Dynamics Library (VDL) of Dymola. One example of applying simulation by Modelica to a future personal vehicle of Toyota is introduced. On the other hand, it became clear that future small vehicles tend to have reduced stability and handling ability than conventional vehicles because of the reasons shown in Figure 1. Figure 2 shows the result of an animation for the open-loop side wind test. It is evident that the future small vehicle is affected much than the conventional vehicle by side wind. To cope with the problem of reduced stability and handling ability, a benchmark problem of improving performance of such future small vehicles was settled by Japanese joint committee of automotive industries and academia. As a member of the committee, the author will introduce the benchmark problem in this paper.

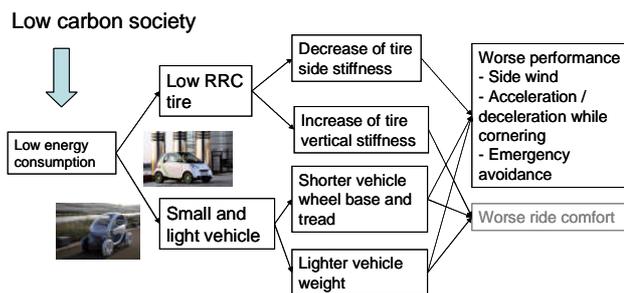


Figure 1: Problems for small vehicles

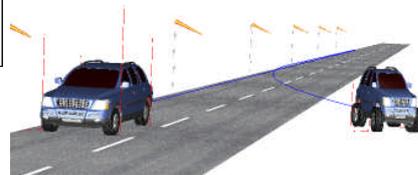


Figure 2: Result of side-wind test

References

- [1] Gombert B., "eCorner – the electric propulsion system of the future", Proceeding of Chassis Tech Plus 2011, pp. 803-813, 2011.
- [2] Katsuyama E., "Decoupled 3-D moment control by an In-Wheel Motor vehicle" Proceeding of Chassis Tech Plus 2011, pp. 133-150, 2010.