Autocorrelation of virtual suspension characteristics to K&C measurement

Customer

Premium Automotive OEM

Challenge

Kinematic and compliance (K&C) measurements are performed on physical cars with different load cases to estimate the suspension characteristics. The same tests are performed virtually to assess the vehicle dynamics attributes of the car. However the virtual car suspension model always differ from the real car suspension, primarily due to manufacturing tolerances. Tuning the virtual model involves adjusting hundreds of suspension harpoints and bushing properties. This task is tedious, time consuming and often extremely difficult due to interdependencies in parameters and responses. The aim was to develop an industry standard procedure for automatic tuning of suspension parameters in the virtual model to match the K&C test data.

Solution

In this project, the suspension was modeled in ADAMS Car, and HEEDS MDO optimization software was employed as a tool for auto-tuning of suspension parameters. For the front suspension model, 81 different design variables were selected. These included all hardpoint locations and bushing stiffnesses. The objective of correlation was to minimize the root mean square (RMS) value between K&C measurement curves and ADAMS simulation curves. From the K&C measurement data, 23 curves were defined as target curves in the autocorrelation process. In 2000 iterations, SHERPA, the proprietary hybrid optimization algorithm in HEEDS MDO, achieved a good correlation of the simulation model to the physical test data. Hence the simulation model is correlated and can now be used in the decision-making process and assessing vehicle dynamic characteristics, therefore eliminating further need for physical testing.

Example: Toe angle response curve