Simulink® aids chassis control design at Delphi

The Challenge

Delphi Chassis Systems needed to develop and test a new vehicle stability enhancement system that would control a skidding car via selective brake and engine intervention. At the same time, they needed to reduce design time and boost engineering productivity.

The Solution

Delphi used MATLAB®, Simulink®, and Real-Time Workshop, along with dSPACE bypass systems, to develop and test new control algorithms.

Engineers began with a model of the control algorithm, which they developed graphically in Simulink. For off-line testing, the Simulink model was easily incorporated into an existing C code vehicle model consisting of vehicle dynamics and powertrain sub-modules. After the successful off-line simulation, the updated model was tested in a development vehicle. Because testing could be done on the same Simulink model, they did not need to create additional C or assembly code.

The car's master microcontroller allowed for use of the original brake system inputs and outputs. In addition to processing sensor inputs and executing the basic brake algorithm, the master microcontroller also fed messages to the dSPACE system by a CAN serial link. A DS1003 DSP board ran the Simulink model that determined appropriate control action. A corresponding calculated output command was sent back to the brake system master controller.

With their new control strategy on a notebook computer, engineers used dSPACE hardware to patch the new control algorithm into the vehicle's existing brake controller in a master-slave configuration. This hardware-in-the-loop configuration allowed them to isolate, verify, and test the new control code while actually putting a car through its paces.

The Results

- **Reduced development time.** Because they could use the same Simulink model for off-line simulation and verification, engineers were able to complete the development algorithm before the winter testing season began.
- **An effective design.** During evasive maneuvers or maneuvers on slick surfaces, the new control algorithm improved vehicle stability, minimized driver effort, and reduced the duration of the skid.

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Application Area

Controls

MathWorks Products Used

MATLAB®

Simulink®

Real-Time Workshop®

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