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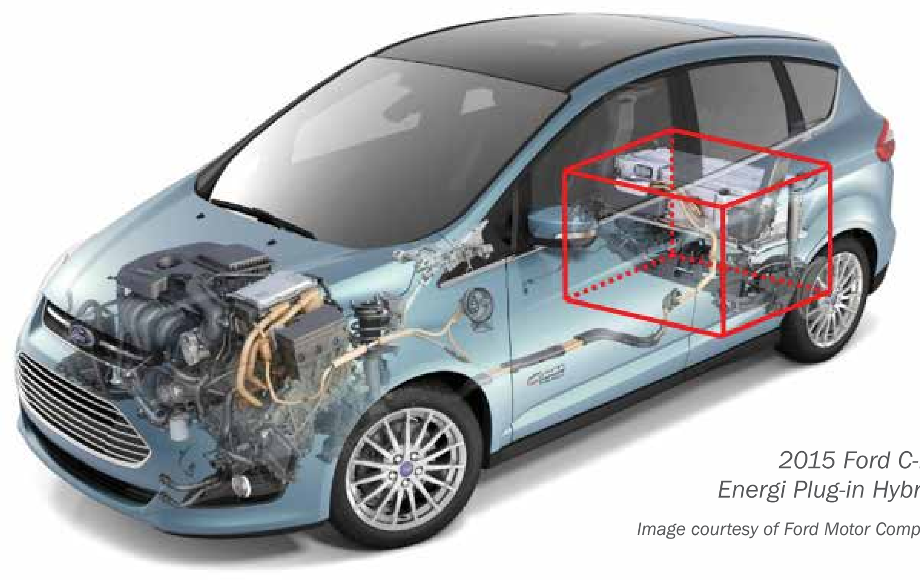

2015 Ford C-Max
Energi Plug-in Hybrid Vehicle

Ford Battery Group Adopts RADIOSS Cut Methodology

Overview

In order to improve the simulation performance and accuracy of a high fidelity battery CAE model, Ford has turned to the cut methodology available in RADIOSS. A full vehicle simulation with simplified representation of battery provides the full vehicle behavior and proper loading conditions at the borders of the battery sub-model. Once the loading information at the sub-model boundaries is extracted from the full-vehicle simulation, Ford's battery core team creates the detailed representation of battery, inside the sub-model, to perform multiple design iterations quickly. This give them more insight in the internal behaviour of the battery and enables Ford to design the best-in-class battery modules and components possible.

Challenge

When working in tandem with vehicle development Ford's battery core team was faced with two conflicting requirements. The vehicle electrification engineering teams required a very detailed CAE model of the battery arrays. This contains each cell, as well as the various packaging configurations that are considered in the design. In order to predict the robustness of the battery structure using CAE simulation the detailed battery core group's model can grow towards several million elements. However, the large battery model needs to be simplified greatly when data is passed to full vehicle teams. Pairing a detailed battery model with the complexity of full vehicle model significantly slows the cycle time and hinders the ability to run optimization and design exploration for both teams.

Solution

Ford's battery core group uses the cut methodology (sub-modeling option) in RADIOSS to resolve the conflicting requirements. A full vehicle simulation is run after selecting a zone including and surrounding battery structure as a sub-model. This also contains a common interface to full vehicle model and full vehicle analysis is simulated using a generic simplified representation of the battery. This provides a quick turn around time while displacement and force history is imposed on the submodel boundaries. This time history data is then extracted at the common interface that was selected previously. Subsequent analysis of a much more detailed battery model use the interface files as input produced from the sub-model analysis.

Results

- 50% reduction in modelling efforts.
- Performance benefit by having suitable models for different purposes.
- Sharing of light interface data between the battery zone and vehicle across different departments.
- Improved accuracy by detailed modelling.

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