Honda Leverages Simulation to Meet Changing Market Needs

The automobile market is in a period of great change, with factors like environmental conservation and rapid market growth in developing countries now coming into play. Model-based development (MBD) is advocated as a development process that can support these changes. The previous leader of engine development for the Honda F1 Team, Kazuo Sakurahara, is currently involved in the creation of a new development process for mass-produced vehicles at the Honda R&D Co., Ltd. Automobile R&D Center. Sakurahara spoke to *3DS SIMULIA Community News* to discuss how Honda uses computer-aided engineering (CAE) and the steps it has taken toward MBD.

3DS SIMULIA Community News (SCN): What kind of effects have changes, such as environmental issues and rapid market growth in developing countries, had on the development workplace?

Kazuo Sakurahara: Speed is everything. Automobile manufacturers need to increase the rate of their development to the point that they can handle whatever changes arrive next, or they are not going to survive.

SCN: How are you increasing the pace of development?

Sakurahara: We strive for a process that makes full use of CAE, aiming to allow for optimization of functions and measurement parameters at an early stage of advanced development. We want to ensure that the development of the hardware skeleton is already complete as the vehicle goes into the development for mass production. MBD will heighten competitive power in comparison with the old experiment and experience-based process.

SCN: Why is Honda focusing so heavily on the use of simulations (CAE)?

Sakurahara: We want to avoid building prototypes. It takes an awful lot of time to build something and then test it. We want to take it to the level that you only have to build something as the final check. For this reason, we desire greater accuracy from our CAE.

SCN: In the development process, how are you making use of CAE?

Sakurahara: At the stage of the advanced development prior to the development for mass production, in the process of selection of specifications and basic design, the designer carries out CAE using 3DS CATIA Analysis in order to check and optimize the specifications. In the detailed design process, the quality of prerelease designs is evaluated using CAE. Areas that are highly integrated and require a lot of time, like nonlinearity and vibration noise, are performed by specialists using Abaqus Finite Element Analysis (FEA).

SCN: What has enabled designers to apply CAE more widely for themselves?

Sakurahara: The evolution of 3DS CATIA is largely to thank for that. The fact that the mesh in 3DS CATIA can be generated more easily than before is a really big factor. The time it takes to generate a high-quality mesh is vital when it comes to using CAE. Furthermore, using optimization tools like Isight greatly reduces the amount of work and time CAE takes, and that's another way in which we are seeking to increase the range of design CAE.

SCN: When do you use Isight?

Sakurahara: Take, for example, the engine. There are all sorts of conflicting requirements—it needs to be as light as possible but strong, to be quiet without too much vibration, yet sufficiently powerful—and you have to find a tradeoff. The existing manual process involves adjusting the model, carrying out CAE, and making a judgment, then repeating this process over and over. In the new workflow, Isight processes numerous design iterations without user intervention, changing the shape of the parametric model automatically during CAE and finding the best possible shape for us.

SCN: With the expansion of applications for CAE in the design workplace, there have been lengthy debates concerning the importance of analytical precision. What do you think about the precision of CAE evaluation?

Sakurahara: For Honda, if you include every degree to which evaluation can be performed, from

complete evaluation to relative evaluation to determine a general policy, we are able to utilize CAE effectively for about 70% of the applications where we would like to do so.

SCN: What do you believe needs to be done to improve evaluation and achieve greater accuracy?

Sakurahara: What is important here is to note that Calibration & Evaluation is seen as “tests to increase the accuracy of simulations.” This means that many more tests are required than if they were just being performed to evaluate simply whether or not the requirements of the design had been fulfilled. It takes a lot of work, but this is necessary in order to increase the accuracy of the physical model that is the start of development using MBD. Feeding the statistical model obtained from the results back into the physical model allows the simulations to come closer to the real world and, in turn, allows greater precision at the start of development. At the moment, the process often goes back and forth between basic design and detailed design, but we want to reduce the need to go backward by increasing the accuracy of the physical model.

SCN: How is this different from the comparison between CAE and experimental results that have been used until now?

Sakurahara: Evaluation using simulations has been about whether or not, under certain specific and limited conditions, the experimental results fit. So, no matter how accurate the results for a certain specific engine, there is no way of knowing whether the results are accurate for a new, totally different engine. In order for us to use MBD in the future, we need to work to feed the experimental results for all the vehicles we develop back into the physical model. In the initial phase, this will increase the number of experiments performed, but as accuracy continues to increase, the number of experiments required will naturally decrease. Organizing this process and building it into the development flow is vital.

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