The Power of Structural Dynamics Simulation

Analyzing time-varying loads helps develop innovative products with vibration, motion and other real-world behavior in mind.

Companies increasingly rely on structural dynamics simulation to study how products vibrate, bend, twist and otherwise move when subjected to loads that vary over time. Whereas static analysis is traditionally used to determine characteristics such as stress and deflection of individual parts under a constant load — such as a weight on the end of a beam — structural dynamics enables designers and engineers to study product behavior in greater detail. Such analysis could include determining the natural frequency of a washing machine so the appliance doesn't jump around in the spin cycle, for example, or calculating the fatigue life of a car suspension to withstand years of pounding by potholes and rough roads.

Structural dynamics is being implemented in an expanding range of applications, as seen in some of this issue's articles. "Predicting Vibrations in High Power Burners" describes how engineers shortened development time by five months by determining an assembly's natural frequencies through modal analysis and refining the design early to avoid these damaging displacements. "No More Dropped Calls" covers the work of an engineering team at EPCOS NL that used multiphysics analysis to account for fluid, electrostatic and mechanical effects in simulating the transient dynamic response of an innovative RF-MEMS switch that promises to reduce the number of disconnected cell phone calls and extend battery life. "Analyzing Random Vibration Fatigue" is about tools based on probability and statistics used to study the damaging effects of highly unpredictable arbitrary loads. There are also advanced tools for studying nonlinear dynamics where large, high-speed loads permanently deform structures. Applications include scenarios such as bomb-blast damage to buildings, ballistic impact of aircraft on power stations, stamping and other metal-forming manufacturing operations, or drop testing of cell phones and other consumer products.

The beauty of this breadth and depth of ANSYS structural dynamics solutions is that they are not confined to specialists intimately familiar with the technology who are running problems on supercomputers. Rather, analysis compression techniques enable most problems to be run on conventional desktop machines. Moreover, analysis models are far easier to set up through the ANSYS Workbench interface — with features for extracting geometry directly from CAD systems, building models with robust meshing tools, and setting up the analysis with a simulation tree that describes problems in user-friendly terminology related to geometry and physical behavior.

In this way, engineers can easily perform structural dynamics simulation as a routine part of development — fixing problems, refining designs and optimizing product performance early in the cycle instead of with costly, time-consuming and usually less-precise physical testing. On a corporate level, forward-thinking manufacturers with the good sense to invest in these tools enjoy the benefits of higher profitability and greater market share through well-engineered products designed with vibration, motion and other real-world behavior in mind. ■

John Krouse, Senior Editor and Industry Analyst

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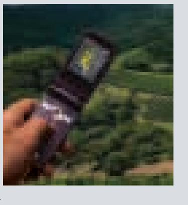
About the Cover
EPCOS NL and Philips Applied Technologies have used simulation to develop an RF-MEMS switch for improving cell phone signal strength.



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