# Speeding Up Development Time for **Racing Cycles**

## Trek Bicycle Corporation cuts product launch delays with simulation-based design using ANSYS Mechanical software.

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Leading cyclists such as Lance Armstrong — six-time winner of the Tour de France — rely on Trek bicycles in the world's premier racing events. Image courtesy Trek Bicycle Corporation.

With seven consecutive Tour de France titles, six straight 24-hour World Solo Championships and a wide range of numerous other professional wins, Trek enjoys a rich tradition of victory in the world's premier cycling events. Headquartered in Wisconsin, U.S.A., Trek Bicycle is a global leader in bicycle design, manufacturing and distribution, with a broad range of bicycles and cycling products under the Trek, Gary Fisher, LeMond, Bontrager and Klein brand names. From the first hand-built steel touring frames to the revolutionary OCLV carbon fiber molded parts first introduced in 1992, Trek's passion for innovation, quality and performance has led the field with forward thinking and next-generation technology.

Success in this highly competitive industry depends on releasing the right products at the right time. To stay at the forefront, Trek continually strives to design and build innovative products that meet the company's stringent strength and stiffness requirements.

A major challenge in one recent project was to increase the speed to market of a cycle with an assembly comprising an aluminum steer tube bonded with epoxy adhesive into a composite fork that is bolted to the wheel axle. ANSYS Mechanical software was used to accurately predict stress levels in the composite and metal fork assembly. The solution was installed by ANSYS channel partner Belcan Engineering Group, which provided training and applications support for composite materials analysis.

In analyzing the fork assembly, component geometries from SolidWorks® CAD models were imported

Component geometry from a SolidWorks CAD model (top) was imported into ANSYS Mechanical software (bottom) to determined the stresses in the fork assembly made of aluminum and composite parts. The simulation reduced the number of lengthy hardware prototype iterations and enabled the company to meet critical product launch deadlines.

into ANSYS software, in which the Virtual Topology feature was used to construct a unified mesh representing the entire assembly of composite and metal parts. Bonded contact elements automatically configured the mesh to account for epoxied parts, thus avoiding the difficult task of manually adjusting mesh densities and selecting element types. The shell lay-up capabilities of ANSYS software were of particular value in representing the complex material properties of composites in regions containing different numbers of layers aligned in various orientations.

The analysis allowed engineers to simulate changes in the lay-up of the composite parts as well as wall thickness of the aluminum parts much faster. The laboratory test setup was accurately simulated and a composite fork assembly ultimately was created that met all of the design parameters and safety standards. This saved considerable time in developing these components and is allowing critical product launch deadlines to be met. Trek engineers are leveraging this knowledge and experience so that the process can be applied to the design of future products.

Trek recognizes the value of Simulation Driven Product Development and is successfully implementing the approach with ANSYS Mechanical software. As the company moves increasingly toward more globalization in its supply chain, the value of analysis becomes even greater as a way of refining innovative designs before building hardware. ■