

Padua University Assists Aprilia

Motorcycle manufacturer improves designs with Working Model 3D simulations

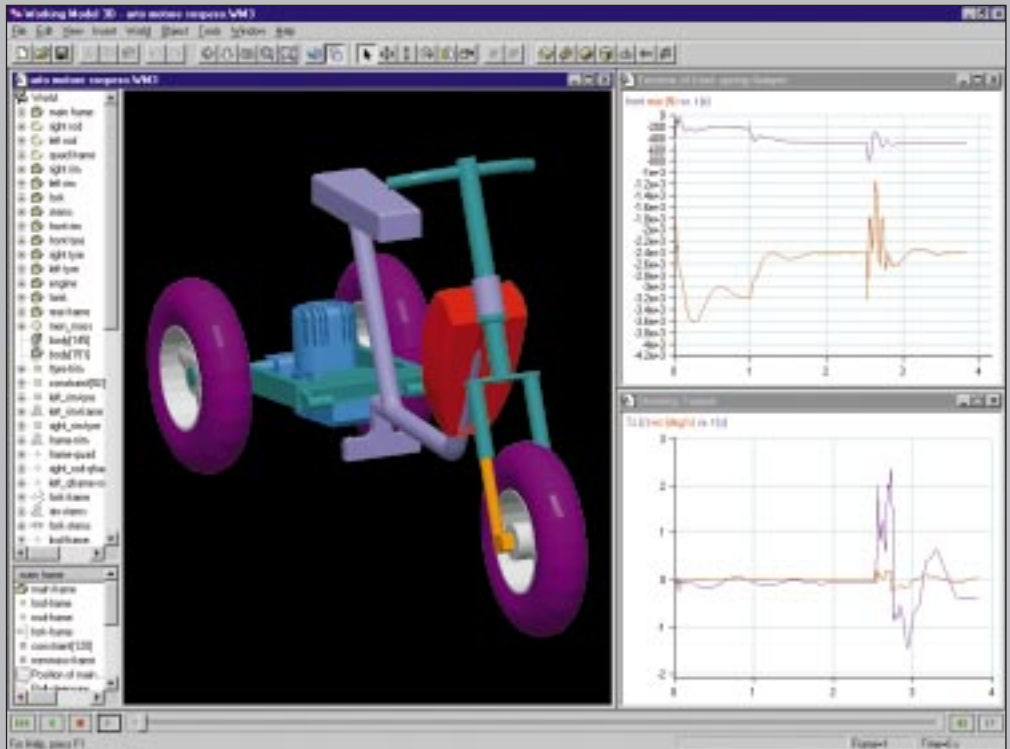
As a professor of applied mechanics at Padua University, Italy, Vittore Cossalter knows that even the best engineering benefits from the testing of prototypes. Working Model 3D and 2D have become an integral part of Padua University's applied mechanics curriculum and associated research. It wasn't long before Cossalter's work and his reputation for innovative design attracted the attention of Aprilia, one of the world's great motorbike manufacturers.

Always eager to maintain their edge in technology and design, Aprilia was fast to embrace the inventive work of Cossalter and his students. Aprilia quickly learned the value of Cossalter's efforts with Working Model when the company invited his staff to tackle problems involving traction, vibration, and acceleration-induced pitching. Using Working Model 3D, Cossalter and his team have created virtual prototypes and simulations to help Aprilia improve stability and safety in models ranging from scooters to racing motorcycles.

In racing, any motion that prevents the competitor from reaching the finish line faster is motion wasted. That includes the occasionally severe pitching of a motorcycle front end in rapid acceleration. With Working Model 2D and 3D, the Padua University team simulated transmission and suspension functions of Aprilia's Model 410 racing bike to test the effects of modifications to those systems.

By simulating the effects of changes in tension, flexibility, and dimensions of components in the transmission and suspension systems, Cossalter's team made a series of modifications that effectively converted acceleration-induced momentum in the vertical axis to more manageable torque. As a consequence, the Model 410 is now faster in critical cornering maneuvers, improving overall lap times and rider safety.

The quest for rider safety has also inspired Cossalter's team to seek practical design



Working Model 3D has helped to improve maneuverability and rider safety in this three-wheeled vehicle.

solutions for use in future vehicles for the consumer market. One concept that has attracted the attention of academics and industry alike is a new three-wheeled vehicle concept.

According to Cossalter, a three-wheeled vehicle is a sensible compromise between the maneuverability and compactness of a motorcycle and the stability and load-bearing capacity of a four-wheeled car. "We believe that a three-wheeled vehicle can be safer and designed for a wide range of dynamic behavior to suit recreational and commercial uses," says Cossalter. "Working Model is letting us explore the mechanics that make that flexibility possible."

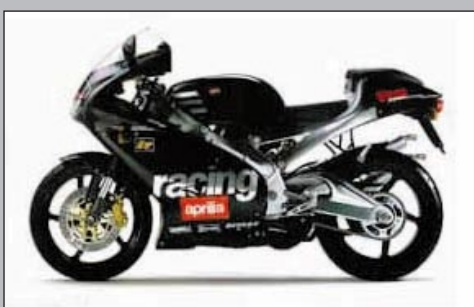
Padua's three-wheeled concept is distinctive for the system linking the rear chassis, which bears the engine and main frame, to the forward chassis, which supports the steering mechanism, forks, and passenger. The linkage system serves a function similar to a ball joint, isolating rolling motion with the forward section of the chassis and keeping the rear section of

the chassis level. The end result, according to Cossalter, is a vehicle that achieves vastly improved maneuverability while reducing the risk of roll-over and load shift. Working Model 3D simulations have also revealed that the system can be safely configured to suit any rider preference or application or engineered to provide varying tension in response to the degree of force in a cornering maneuver.

"Working Model 3D enabled us to consider this design very thoroughly," says Cossalter. "The interface is very easy to use and understand which allows us to work and consider design iterations quickly, and the product is robust enough to perform reliably and error-free even in complex calculations."

Using Working Model, Cossalter anticipates that the software will continue to accelerate the learning process and the development of technology. "Working Model is excellent for establishing the feasibility of a design before we have to commit resources," says Cossalter. "We know much sooner whether an innovation will be meaningful or not."

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Motorcycle images courtesy of Aprilia.