



FOR TOYOTA SAFETY COMES FIRST

www.toyota-forklifts.it

“After an initial testing period with competitors simulation systems” - Eng. Bonelli, manager of Advanced technology office in Toyota Material Handling Manufacturing Italy Spa declared - “We asked to EnginSoft, as our partner, to consider RecurDyn software solution, setting up a joined pilot project in order to carefully evaluate the software and avoid dangerous risks; this testing period has fully satisfied our needs also thanks to the competence of EnginSoft technical staff. For this reason we have finally decided to choose RecurDyn which proved to better fit our needs than its competitors both in terms of performance and usability “.

“We are confident that the use of this tool will allow us to simulate multi-body analysis and dramatically reduce the product development time, enabling us to evaluate many more design alternatives, improving the quality of our projects and reducing costs.”

“We fully rely on our decision” – concluded Eng. Bonelli -”and it will prove to be the best solution, in line with the policy of the Toyota Material Handling Manufacturing Italy that has always been a company oriented to invest in the best technologies”.

Eng. Giovanni Paolo Bonelli
Advanced Technology Manager
Toyota Material Handling Manufacturing Italy

Toyota Material Handling Manufacturing Italy Spa (for the purposes of this article, hereinafter referred to as TMHMI) offers a complete range of high quality products, services and solutions designed to maximize safety and productivity, thus limiting costs. The wide range of forklift trucks and warehouse equipment of the top brands, Toyota, BT and CESAB, can satisfy every kind of need in loading and unloading operations, in order



commissioning, in height storage and horizontal transport.

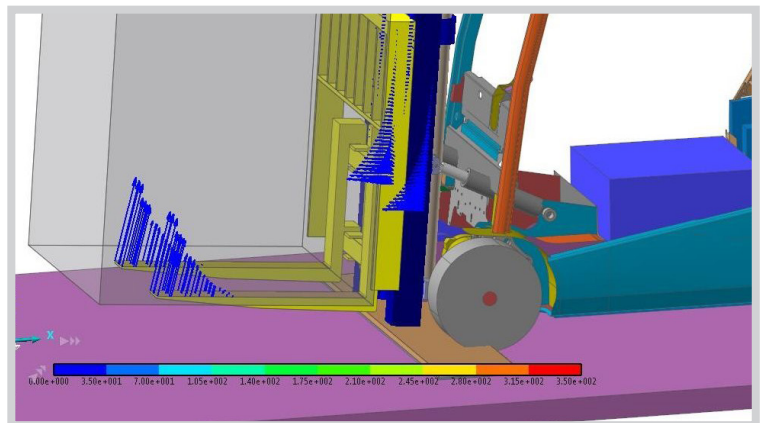
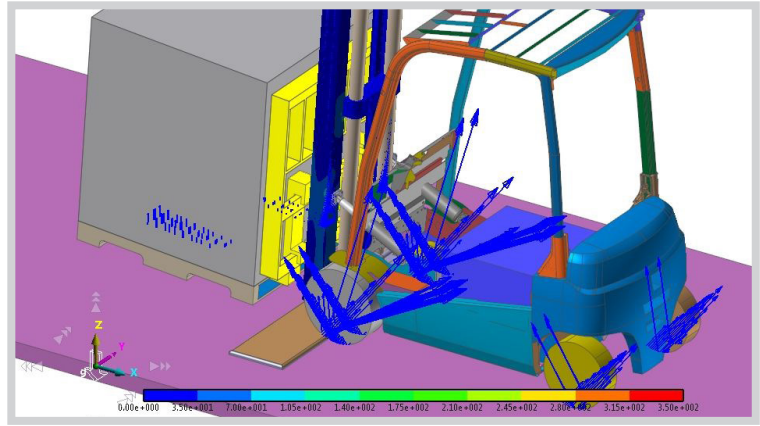
In particular, the robust and wide range of Toyota counterbalanced trucks, is designed to perform all the operations of loading and unloading, storage, interlocking bays of load and horizontal transport of goods, to be carried both inside and outside of the warehouse. Thanks to the wide range of electric and IC trucks, the innovative uprights and the forefront technology, Toyota counterbalanced trucks provide a suitable solution for any application requirement.

Using RecurDyn for design

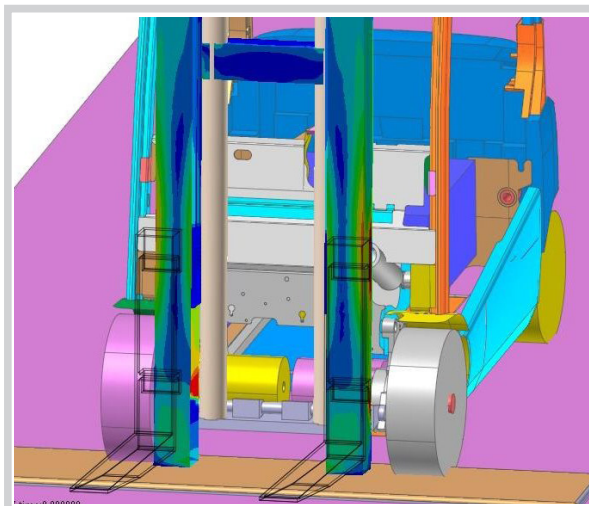
Forklift trucks are vehicles designed to lift and transport loads of considerable entity. In the development process of a vehicle, it's necessary to consider different types of load, both static and dynamic. Dynamic loads occur when the vehicle crosses an obstacle, when braking suddenly or in emergency conditions. In all these cases, the inertial effects greatly amplify the internal forces affecting the bearing structures.

The Multi-body simulation offers a very reliable support to virtually analyze these conditions, anticipating the criticalities that would otherwise emerge only in the testing phase of the truck. For this reason, TMHMI decided to acquire a multi-body software, able to represent the truck in any use condition. The modeling is facilitated by the graphical interface that allows to virtually assemble the truck simply using the mouse. Such simplicity hides, in reality, considerable numerical refinements.

For instance, the interaction of the tire with the road is simulated with different levels of complexity, as a function of the analysis objectives



(either elastic non-linear contact or RecurDyn Tire modulus). Similarly, the interactions between the bodies constituting the truck, can consider both the use of connecting joints and non linear contacts. The latter ones are particularly powerful in RecurDyn platform. Geo-Contact owner technology and the rich library of analytical contacts, allow a level of real physics description with incredible results. The analyses performed in the evaluation phase have proved how much the accuracy of the contacts between the load and the forks can affect the final result of the simulation. The remarkable results described above have been achieved with the already powerful configuration of RecurDyn/Professional.



Nevertheless, TMHMI has decided to equip itself also with the RecurDyn Toolkits. They are special modules, which enable to create extremely complex subsystems, such as drive chains, the mass-distributed springs, bearings and drive belts. The Toolkits incredibly accelerate the model set-up time, avoiding time-consuming and repetitive operations to the user. The RecurDyn solver represents a further plus for the platform, in fact none of the completed analyses, even the strictest ones, have been characterized by convergence difficulties.