ELECTRIC DRIVEN CATERPILLAR VEHICLE

A BASIC CONCEPT OF THE ELECTRIC DRIVEN CATERPILLAR VEHICLE „ARDENNER“ WAS DEVELOPED BY MATTRO. THE VEHICLE CONCEPT SETS ITSELF AGREEABLY APART FROM OTHER EXISTING CATERPILLAR VEHICLES ON THE MARKET. SPECIFICATIONS ARE AIMING FOR HIGH LOAD CAPACITY, HIGH TILT STABILITY, MANOEUVRABILITY, FLEXIBILITY, ECOLOGY, AND LOW NOISE EMISSION.

The electric driven caterpillar vehicle „Ardenner“ can be used in summer and winter season based on the caterpillar drive. To fulfil these aims and to present an ecologically coherent concept a light weight chassis was demanded. Based on a detailed specification (different load cases) and a given design space, different concepts of the chassis were developed. Starting point of these concepts was a so called topology analysis conducted with Altair OptiStruct®. By applying different load cases on the full body of the design space assigned a specific material the software is calculating a density contrast from 0 to 1 to bear the loads. The result of the topology analysis was evaluated with respect to a workable wood-hybrid structure. In total seven iterations were developed and analyzed, while one feasible variant was selected and optimized by the so called free-size method. This method permits the engineers to discuss and to optimize the structure body-in-white. Following this phase, a FE model (DYNAMORE) was build up based on a material model and material cards.

Source: MATTRO, Wood-hybrid structure of the caterpillar vehicle „Ardenner“
SUCCESS STORY

The whole design process of the wood-hybrid structure was strongly supported by the different CAE tools and was characterized by an optimal interdisciplinary interaction between mechanical engineers and wood technologists.

For the manufacturing process of the demonstrator in the lab the different production processes and possible quality relevant aspects (supported by LEAN MC) were systematically analysed corresponding to the automotive development processes. The demonstrator was manufactured in strong cooperation of the academic partners and WEITZER PARKETT. EJOT and COLLANO supported the project by providing adequate screws and glues. The vehicle was coated by specialists of WEITZER PARKETT with epoxy-acryl provided by the company Timeout. For the demonstrators an opaque black lacquer was selected (which is unfortunate for a public display, as the components made of wood are not apparent). Therefore, no wooden surfaces are visible on the finished vehicle.

Impact and effects

During the work on the use case „Ardenner“ it was clearly demonstrated that CAE tools, a knowledge-based and analytic approach helps to reduce time and effort in R&D. In comparison to the baseline version made of ‘steel’, the wood-hybrid structure saved around 150kg in weight. FE modelling indicated that the wood-hybrid structure shows the same performance as the baseline version made of steel. Test drives are planned to provide valuable data to verify the CAE driven design.