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Please identify the event for which your submitting?	NAFEMS UK Conference 2018
Will you be the presenting author?	Yes
Presentation Title	A model-based design methodology for rapid preliminary landing gear design
Relevant Themes / Keywords	Multibody simulation, Landing gear, Model-based design, Finite Element Analysis

Abstract (plain text)	This paper presents a design workflow for the conceptual and preliminary design of landing gear systems. The workflow addresses some of today's engineering challenges that engineers face during the design of innovative products. The research activities are performed in the context of the Flemish ConcEval project with the aim to develop a model-based design framework for the development of lightweight products. This work of Siemens PLM focusses on the landing gear preliminary design use case in collaboration with Fokker Landing Gear. One challenge is the long duration to set up engineering simulations, preventing a streamlined design process. Design changes often have to be pushed even when the simulation results of the previous design and feedback of the simulation expert are not available yet. The simulations also takes too long to perform a sufficiently large design space exploration in the early stages of the design process. The integration of development activities can lead to a sharp reduction in simulation setup time, enabling an enhanced exploration of the available design space. Another challenge is the product data management, which is a three-fold problem. First, the importance of simulation leads to a large stream of valuable data which can provide valuable insight in the design performance before prototype availability. Without proper data management, the data risk to get lost or decisions risk to be taken based on old or invalid data. For example, a product's components are usually dependent on each other so a parameter change of one component can affect all components. Third, the data need to be accessible to people with different backgrounds requiring the data to be stored in a very structured and understandable format. The proposed workflow makes use of the object-oriented paradigm to structure data and represent them in an understandable fashion. The data are linked to a commonly shared product architecture. A crucial step in the workflow is the synthesis of simulation models based on the product architecture and the parameters of the components. This enables an efficient design process with model reuse, thereby tackling the mentioned engineering design challenges. The design of the landing gear starts from a valid product architecture. A conceptual design is produced by using empirical knowledge and basic analytical or numerical models. From the basic geometry of the landing gear, the static ground loads are determined. Then, a multibody simulation model is synthesized from a library of models that represent the components of the product architecture. At this stage the multibody simulation consists of rigid stick models. The loads on the joints between the different components are found by running static analyses for all load cases. Afterwards, the most critical ones are selected. The interface loads are used to size the individual components using finite element analysis, handbook methods or numerical simulation models. Subsequently, new component models are created accounting for the flexibility of the components. New static analyses are performed which leads to a more accurate prediction of the interface loads. The parameters of the models can then be optimized to achieve the most lightweight product or a solution that depends on a combination of key performance indices. Dynamic simulations can be performed inside this optimization loop or afterwards as validation cases. In the next stage, Siemens PLM Teamcenter will be used to define the product architecture, to trace back the simulation results and preserve the associative links between the components of the system. The combination of a PLM system and the synthesis of simulation models enables a large design space exploration with simulation-based performance evaluation. This leads to a confident preliminary design that can be worked out into detail afterwards.
Please enter any additional comments or messages here	Work is in collaboration with Fokker Landing Gear. Co-authors will be indicated in the extended abstract.
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