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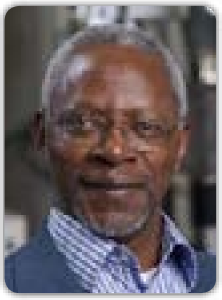

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Integrated forming processes and drop test simulations for a helicopter skid landing gear cross beam

In this work, a new helicopter skid landing gear cross beam is presented. Thanks to a revisited design, this part can be easily fabricated by tube hydroforming. The strength and energy absorption during emergency landing are the same for the new crosstube and for the actual crossbeam, but the new design is lighter. The manufacturing process is also "greener" and more cost-effective than the chemical milling process currently in use. For a better assessment of the structural integrity of the aerospace components, a methodology based on the integrated computational material science and engineering (ICME) technology for the multistage manufacturing processes of a helicopter skid landing gear component is used. Simulations of the manufacturing sequence and drop test are performed in an integrated manner. The tube is first bent, then crushed and hydroformed. After hydroforming, the tube has to be heat treated to bring the material into an artificially aged condition. The final material properties depend on the amount of plastic strain experienced by the material during the forming processes, which varies from one part of the tube to another. This is taken into consideration for the simulations of drop tests and quasi-static loading of the part. Results from the simulations are compared to experimental results for bending, hydroforming, and quasi-static loading. By combining targeted physical testing with advanced materials and process modeling, the product design and manufacturing process can be optimized together at the early stages where cost of design changes is much lower. A better understanding of what happens to the material during the various processes and how to improve them can thus be achieved and the design engineers are enabled to optimize the component while maintaining security margins.

Biography

Augustin Gakwaya is a Professor of Computational Mechanics and Computer Aided Design and Engineering in the Department of Mechanical Engineering of the Université Laval for more than 25 years. He also works as graduate program Director for master of aerospace engineering. He is a Mechanical/Aerospace Engineer, specialized in material modeling and non-linear computational coupled thermo-mechanics, optimization of metal forming process (powder metallurgy, deep drawing, forging, extrusion), shell elements for non-linear implicit and explicit FE and meshless (SPH) modeling and technology, evaluation/selection of materials, inverse modeling and identification of material models, integrated forming process modeling and virtual production systems, durability and structural integrity of aerospace composites structures under shock and impact loading. In last five years he successfully lead multi-partners research projects related to: High velocity impact modeling of composites aircraft structures (bird strike, hail impact, ballistic limits), Integrated computational materials engineering for design, process optimization and virtual manufacturing of aerospace components.

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