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Corresponding author: PRADAS GOMEZ, Alejandro

e-mail of corresponding author: Alejandro.Pradas@chalmers.se

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Title

Design automation strategies for stress analysis in critical aerospace components during conceptual design phases

Authors

Alejandro PRADAS GOMEZ ^{*,1,2}, Tobie VAN DEN BERG ³, Massimo PANAROTTO ¹, Ola ISAKSSON ¹

* Corresponding author alejandro.pradas@chalmers.se

¹ Chalmers University of Technology, Gothenburg, Sweden,

² GKN Aerospace Engine Systems, Trollhättan, Sweden

³ GKN Fokker, Papendrecht, 3351 LB, The Netherlands, tobie.vandenberg@fokker.com

Abstract

The conceptual design of aircraft engines and airframes is typically conducted using low resolution structural models. The jet engine has reached a plateau of architectural configurations, where traditional expert knowledge is used to size and choose configurations based on the low-resolution models. As aerospace manufacturers undergo a sustainable transformation that require larger architectural studies, the need to evaluate a large variety of conceptual designs arises. The structural component design space now subject to new environments that require detailed analysis for designers to choose and minimize risk of re-design on later stages of the product development.

This paper reviews the literature for design automation techniques to bring detail analyses to the conceptual phases. A review of the different strategies is discussed, as well as the different domains of automation in the product development process, such a geometry generation [2] or an structural and cost analysis [8]. The state of practice of design automation strategies is obtained through interviews at aerospace companies within the DEFAINE project for an overview of the State of Practice. The different technologies are also mapped to the product development phases.

Additionally, a generative model strategy is proposed for the automation of high-fidelity models in the jet engine structural components, highlighting the differences of jet engine (such as [4][5][6]) with the airframe structural components (such as [9],[3]). A basic library has been created and an engine product is used as a show case for the methodology. The framework relies on Knowledge Based Engineering methodologies [1][4].

The review of the state of practice of automation strategies can be useful for both academia and design companies. It also provides a view on how can detailed models be structured to generate a library where future products can re-use the knowledge to reduce development efforts and speed up the assessment lead time.

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