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Corresponding author: Baan, Max

e-mail of corresponding author: max.baan@parapy.nl

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Title

DEFAINE - Design Exploration Framework based on AI for front-loaded Engineering: Achievements and Open Challenges

Authors

Max BAAN^{1*}, Reinier van Dijk¹, Tobie van den Berg², Petter Andersson³, Robin Augustinus⁴, Ingo Staack⁵, Christopher Jouannet⁶, Gianfranco La Rocca⁷, Bastiaan Beijer⁸, Massimo Panarotto⁹, Peter Edholm¹⁰

¹ ParaPy B.V., Delft, The Netherlands, max.baan@parapy.nl

² GKN Fokker, Papendrecht, the Netherlands, tobie.vandenberg@fokker.com

³ GKN Aerospace Engine System, Trollhättan, Sweden, petter.andersson@gknaerospace.com

⁴ GKN Fokker, Hoogerheide, the Netherlands, Robin.Augustinus@fokker.com

⁵ Linköping University, Linköping, Sweden, ingo.staack@liu.se

⁶ Saab AB, Linköping, Sweden, christopher.jouannet@saabgroup.com

⁷ TU Delft, Delft, the Netherlands, G.LaRocca@tudelft.nl

⁸ KE-works, Delft, the Netherlands, bastiaan.beijer@ke-chain.com

⁹ Chalmers University of Technology, Gothenburg, Sweden, massimo.panarotto@chalmers.se

¹⁰ PE-geometry, Mölndal, Sweden, peter.edholm@pe-geometry.se

Abstract

To accelerate the development of new sustainable solutions and remain competitive in the global aerospace market, European companies are exploring new product development approaches that can drastically reduce lead time. The EU funded DEFAINE project proposes companies to adopt a front-loaded development process. The DEFAINE project will develop solutions to realize this process in a Design Exploration Framework.

Through this process, companies gain more knowledge regarding the effect of design decisions on designs and can more quickly respond to any customer requests and changes. In addition, it allows looking at non-conventional, novel and/or better designs that were not possible to explore through current engineering processes. This will lead to lower design cost, shorter lead-times and a better predictability of results thereby strengthening market competitiveness.

The framework enables the exploitation of a front-loaded product development approach. Front-loading significantly reduces the inefficiencies of the current engineering approach by enabling large-scale design exploration early on or even before the start of a project. To this purpose, the framework enables fast generation of distributed, re-configurable multidisciplinary engineering workflows, built on flexible sets of design and analysis automation solutions, largely based on Knowledge Based Engineering (KBE). The workflows are fed with varying sets of parameters and requirements, to automatically perform multiple design exploration studies. With the help of AI techniques, the produced and stored design solutions are analyzed to

mine new knowledge. At the actual start of the project, pre-optimized solutions for the given set of requirements, can be directly retrieved from the sets of previously stored designs.

This paper addresses challenges faced in the current engineering approach. The novel front-loading methodology is presented, together with innovations in the fields of (i) KBE systems and Model Based Systems Engineering, (ii) workflow systems, (iii) data analysis and (iv) computing infrastructures. These innovations are illustrated using practical industrial use cases provided by GKN [1-5] and SAAB [6]. The paper concludes with an overview of the main challenges still open.

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