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Reviewer´ s report on doctoral thesis "Optimisation of Motorcycle Frame from Composite Materials Considering Manufacturing Technology" by Lukáš Gregor

a) Achieving the set goals of the dissertation thesis

Presented dissertation focuses on the optimisation of a motorcycle frame made of carbon-fiber reinforced polymers. Two main objectives were set for the work: to compare the structural stiffness and strength of the existing composite frame with the properties achievable through topology-driven geometry modifications, while maintaining the same laminate lay-up and identical input conditions and to demonstrate how topology optimisation can serve as a supporting tool for the design of manufacturable composite structures without altering the principal material composition. To achieve the goals of the work, it was necessary to perform and evaluate several number of experiments including measurement of technological sample for validation with results from numerical simulation. All goals of the submitted dissertation were fulfilled.

b) Level of analysis of the current state of art

Current state of art is described in Chapter 2 on 30 pages. It is divided into four parts – review of manufacturing technologies with resulting technology, which is applicable on motorcycle frame, review on optimisation techniques, design requirements for motorcycle frame which lead to optimisation tasks and technological limitations (structural stiffness, strength and Integration of auxiliary systems) and a baseline design analysis. A sufficient number of references, including those from recent times, are used in the analysis of the current state of art.

c) Theoretical and practical contribution of the dissertation thesis

Presented dissertation shows manufacturing of the baseline monocoque design in two versions with different laminate lay-up (A and B) and optimization of B version for three critical operating scenarios - braking, jump landing, and cornering. From the practical contribution of the thesis Chapter 3, where manufacturing of composite parts and bonding operations are described, is crucial. Results from topology optimisation (Chapter 5) were used for design and manufacturing optimisation (Chapter 6) which combines the theoretical and practical contribution of the thesis. Original and optimised design was analyzed by FEM in Chapter 7 from the stiffness and strength point of view. Compared to the original design, the optimised achieved improvements in key structural parameters by several tens of percent, while maintaining both mass and laminate lay-up.

d) Suitability of the applied methods and their application

The selected experimental (DIC, photogrammetry) and numerical (FEM) methods follow current trends, and it can be stated that they were used appropriately.

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e) Formal level of the dissertation thesis

The work is in order in terms of form and language and has a logical sequence. It is divided into 10 Chapters which correspond to the set goals and necessary sub-goals. There are a few typos and ambiguities, but they do not reduce the quality of the work. The author's publishing activity is very good (4 articles + 1 conference paper indexed in WoS/Scopus, 4 conference papers on international conferences).

f) Evaluation of the thesis statement

The thesis statement clearly and qualitatively summarizes the individual goals of the dissertation and their corresponding chapters on 43 pages. It contains a professional CV of the author, which lists his academic and pedagogical achievements.

Reviewer´s remarks

- Mentioned strength theories should be supported with appropriate equations.
- Typos in Section 3 (there is a reference to Section 4.1 and 4.2 instead of 3.1 and 3.2), Czech text in Fig. 61 and 62, wrong numbering of figures.
- The author's results that have been published should be referenced in the text.

Reviewer´ s questions

- Tsai–Wu theory was used for evaluation of IRF. In Abaqus software you have to use cross-product term coefficient f^* or biaxial stress limit as an input value when using Tsai-Wu. How is it Ansys software and where were the required values taken from?
- Three strength theories were mentioned (maximum stress, maximum strain and Tsai-Wu). Which of them is used in figures (94 and 95 for example)?
- Properties of the adhesive simulated by bonded contact were taken from the manufacturer or were they measured by author?

Reviewer´ s statement

The submitted thesis of Lukáš Gregor represents a significant contribution to the field of composites manufacturing technology and possible use of topology optimisation in composite bonded shell-type structures.

All goals of the submitted dissertation were fulfilled and suggestions for further research were outlined. The dissertation contains original and published results, demonstrates the ability and readiness for independent activity in the field of research or development and meets the conditions specified in § 47 Section 4 of the Act.

Based on the above facts, I recommend the thesis of doctoral student Lukáš Gregor for defence.

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