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### Reviewer report of the PhD dissertation

submitted by Mr Hugo Miguel Andrada Lopes Figueiredi da Silva,  
entitled „*Optimization of the Mechanical Behavior of Hollow-box Beams*”  
prepared under supervision of dr hab. inż. Jerzy Wojewoda, Łódź 2018.

The structures of the dissertation:

- 120 pages of the thesis dividing into 8 chapters
- 78 pages of appendix

The thesis is devoted to optimization of novel beams and comparison with conventional hollow-box beams (HSS). The stated problem of improving the effective mechanical behavior of the studied internally reinforced hollow-box beams is a very important, reasonable and valuable contribution to the analysis of thin-walled structures. The methodology applied in this work can be applied as a way of similar solution for other beams of such type in further engineering practice. A well-chosen bibliography and conclusions end every Chapter.

The very clear motivation, thesis of the work, methodology and a bibliographic review is presented in Chapter 1.

Relevant theoretical concepts, mainly related to the Finite Element Method, structural stiffness, structural optimization (including constrained and non-constrained optimization, as well as sequential quadratic programming) and materials selection is described in Chapter 2.

Next Chapter deals with numerical studies on the mechanical behavior of hollow-box beams subjected to static loadings, as well as 12 applied geometries of the novel beams and comparison with hollow-box beams (named hollow-solid sections).

Verification of those selected geometric variables is suitable for optimization purposes based on the sensitivity analysis carried out for one of the FEM models (internally reinforced beams) as presented in Chapter 4.





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In Chapters 5 and 6 the optimization results of novel beams are presented, respectively in terms of stiffness and strength behavior.

Experimental validation of the physical model of one of the beams is presented in Chapter 7 (experimental results are compared with numerical one).

The last Chapter is devoted to a general discussion, conclusions and future work.

The layout of the doctoral dissertation is logical and thought out. Experimental research and extensive numerical calculations are of great value.

In chapter 5, the objective function is defined, but in the formulated optimization problem there are no constraint conditions (geometric and strength – allowable stresses). The doctoral dissertation also lacks a beam scheme. Despite these comments, the work is very valuable, and one should also pay attention to the academic achievements of the doctoral student, i.e. 10 papers:

- 1 article published in *Materials Science Forum*
- 3 articles published in *Mechanics and Mechanical Engineering* and 1 accepted for publication
- 3 articles published in *Applied Mechanics and Materials*
- and 2 articles accepted for publication in *Advanced Engineering Forum*.

In summary, taking into account the above, the presented work meets the requirements of doctoral dissertations. Therefore, I strongly recommend to accept the thesis of Hugo Silva, and I put the request for admission to the public defense.

*E. Wojnicki-Blański*