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External Examiner Report – Doctoral Thesis

Report due date: Oct 13, 2020

Name of Student: Khalil Bassam ALHANDAWI

Degree/Unit: Doctor of Philosophy, Department of Mechanical Engineering

Thesis title: Optimization-driven set-based design for dynamic design requirements

Thank you for your valuable contribution to this student's examination. As a thesis examiner, you will complete this form and attach a written report providing a detailed justification of your evaluation. The deadline to send **this form and your written report** to thesiscoordinator.gps@mcgill.ca is Oct 13, 2020 .

Please note that a late report has serious academic and financial consequences for the student.

Evaluation of the Thesis: Complete the evaluation grid below and comment on the criteria in your written report.

Criteria for Evaluation of Thesis	Excellent Top 10%	Very Good	Good	Satisfactory	Unsatisfactory
1. Makes an original contribution to knowledge	◉	○	○	○	○
2. Advances knowledge in the field	◉	○	○	○	○
3. Is situated in a broader context and appropriately acknowledges the larger field of research (e.g., citations/references)	○	○	◉	○	○
4. Details methodology and methods	◉	○	○	○	○
5. Reports results clearly	◉	○	○	○	○
6. Justifies analyses and conclusions	◉	○	○	○	○
7. Discusses implications	○	◉	○	○	○
8. Is presented appropriately for disciplinary norms (grammar, style, coherence, cohesion)	○	◉	○	○	○

Overall Recommendation: Select one.

Recommendation	Select ONE
PASSED – The thesis is **ready to proceed** to the Oral Defence. • Your written report must include any recommendations for minor revisions to the thesis (i.e. stylistic or editorial changes). • Your written report **must include questions** to be asked of the student at the Oral Defence.	◉
NOT PASSED – Major revisions to the thesis are required **before proceeding** to the Oral Defence. • At least one of the Criteria for the Evaluation of the Thesis must be judged as unsatisfactory if the thesis is NOT PASSED. • Your written report must include a detailed description of all the shortcomings that have informed your decision, including an itemized list of substantive issues to be addressed before the thesis can be given a PASS and proceed to the Oral Defence. Note: If this is the first "NOT PASSED" assessment, the student will be given one opportunity to revise and resubmit the thesis.	○

DATE : Oct 13, 2020 SIGNATURE : Jitesh Panchal Digitally signed by Jitesh Panchal Date: 2020.10.13 09:50:15 -04'00'

(Prof. J. Panchal)

Overview: The author presents computational methods for design under changing requirements. The contributions of the thesis include a design framework for identifying sets of scalable optimal designs, and a tool for design margin quantification and allocation. The framework has been demonstrated using an industrial case study of a Turbine Rear Structure (TRS).

Review: This is an outstanding PhD dissertation! The author has developed a novel framework for an important class of design problems involving changing requirements. The framework is built using state of the art methods in design optimization.

The dissertation is very well written. The chapters are nicely connected. The problem is well motivated. The methods and the results are clearly described in sufficient detail.

I suggest one minor change. Please compare the proposed metrics and approach with methods based on design capability indices:

- Simpson et al., "Designing ranged sets of top-level design specifications for a family of aircraft - An Application of design capability indices" https://doi.org/10.2514/6.1997-5513
- Chen et al., "Using Design Capability Indices to satisfy Ranged Sets of Design Requirements" 96-DETC/DAC-1090.

Questions for the oral defense:

1. What are the implications of the proposed method on the computational cost for design? Is it possible that the cost of executing this method exceed the cost of simply redesigning a product in response to changing requirements?

2. Can the proposed approach be extended to consider topology-optimization-based design? If so, what changes will be needed in the overall framework?