THESIS REVIEWER'S REPORT

I. IDENTIFICATION DATA

Thesis title:	**Automated Image Processing Methods for Impact Dynamics Experiments**
Author's name:	**Jan Stoklasa**
Type of thesis:	bachelor
Faculty/Institute:	Faculty of Transportation Sciences (FTS)
Department:	Department of Mechanics and Materials
Thesis reviewer:	Lena Leicht
Reviewer's department:	Institute of Concrete Structures, Technische Universität Dresden

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment **extraordinarily challenging**

How demanding was the assigned project?

It is not easy to develop and validate a new software for the image analysis and implement both the evaluation and a GUI in MATLAB.

Fulfilment of assignment **fulfilled**

How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.

The goal of automatically detecting randomized patterns was achieved. The obtained results were very similar to the data resulting from strain gauge measurements, proving that the algorithm works very well. Moreover, a GUI to enable user-friendly evaluation with the routine was developed.

Methodology **outstanding**

Comment on the correctness of the approach and/or the solution methods.

The developed routine enables automated pattern tracking, which was its main focus. Moreover, the usability is guaranteed by the GUI.

Technical level **B - very good.**

Is the thesis technically sound? How well did the student employ expertise in the field of his/her field of study? Does the student explain clearly what he/she has done?

Yes, the developed method is reasonable. The thesis deals with the tracking of the dynamic behavior of materials that are, amongst other fields of application, also used in aviation. The explanations are mostly clear and understandable. However, some of the explanations are split to multiple sections which makes some small parts harder to follow.

Formal and language level, scope of thesis **A - excellent.**

Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?

Notations are clear and abbreviations are explained. The thesis is well-structured and the length is adequate. The language is very well readable and understandable.

Selection of sources, citation correctness **A - excellent.**

Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?

All literature was correctly cited. The literature review on image processing is sufficient.

Additional commentary and evaluation (optional)

Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.

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The thesis is well-written and, in most parts, very well-understandable. The developed method is very interesting and could improve optical measurements a lot. The GUI that the student developed makes the edge detection algorithm very easy to employ. The thesis is well-structured and the language is well-understandable.

III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

The thesis is a solid work that explains the methods and results in a very good manner. The results are compared in a well-understandable way, both qualitatively and quantitatively. The developed edge detection algorithm was very reliable. Thanks to the developed GUI, the method can be easily used to optically track pattern movement. That makes the developed software very valuable for the evaluation of SHB data.

Questions:

1. *What are Regions Of Interest (ROI) and what are they needed for?*
2. *What is the difference between DIC and image recognition? What are the advantages of each method?*
3. *What are the main goals of performing SHB experiments?*
4. *Why was a test without a sample used to develop and verify the new software? (Section 2.7)*
5. *Does the threshold of at least 35 recognized pixels in a single column depend on the physical size of the pixels in mm or is it valid for any pixel size? (Section 3.1) What problems can arise due to this approach?*
6. *Should the recognized pattern rather be smaller (disregard certain pixels) or larger (include parts of the background)? (Section 3.1.1)*
7. *Why is the pattern size relevant in the case of the rigid body movement of the bars? (Section 3.2)*
8. *Please explain the advantages of the vertical edge detection. Why is a lower number of mask pixels beneficial? (Section 3.2)*
9. *How does the deterioration of light conditions affect the edge detection? (Section 3.4.1)*
10. *Why is the picture updated in RaDIC and what does that mean? (Section 3.4.1)*
11. *Why does the incident bar velocity of the edge detection match the strain gauges in the case of the 3D print bulk sample while the transmitter bar results differed? (Section 3.4.2) Can you use the second or a further column of pixels for the edge detection if the first row is affected by debris so much?*
12. *Where do the smaller oscillation peaks in the edge detection and MATLAB DIC come from? (Figure 3.15)*
13. *Would it be feasible to filter the DIC data for a more reliable velocity evaluation, especially in the case of the PASLS sample? (Section 3.4.3)*
14. *How can optical measurements be improved in the case of strong specimen debris? (Section 3.4.3) Why is the debris in the case of the concrete sample less critical for the optical measurements?*

The grade that I award for the thesis is **A - excellent.**

Date: **24.8.2023** Signature: