

I. IDENTIFICATION DATA

Thesis title:	Design of a Robotic Manipulator for Loading of Strip Detector Staves
Author's name:	Jan Brajer
Type of thesis :	master
Faculty/Institute:	Faculty of Mechanical Engineering (FME)
Department:	Department of Designing and Machine Components
Thesis reviewer:	Charles Evans
Reviewer's department:	External – Rutherford Appleton Laboratory, United Kingdom

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment <i>How demanding was the assigned project?</i>	extraordinarily challenging
<p>Delivering a working motorised assembly capable of loading staves onto a support structure whilst mounted in a spatially constricting environment has been a very challenging design and construction assignment. This is especially true given the lack of prerequisite work on the topic meaning much of this was developed as a first attempt, and had to meet Atlas project deadlines for key reviews. Jan has also been a consistently regular participant in the weekly meetings for stave insertion development.</p>	

Fulfilment of assignment <i>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.</i>	fulfilled with minor objections
<p>The SIT was designed, built, and tested by Prague CTU, and later shipped to the UK for further testing in a representative working environment. The large scale mechanical framework is suitable for the stiffness needs, and as shown in the analysis section it is the smaller rib sub-assemblies which require further development to eliminate the excessive movement of what is to be a precision insertion device. Whilst the industry technology background content is useful for justifying design choices, perhaps this could have been condensed in favour of more attention on explaining the results from testing and analyses and their relevance with reference to the specification.</p>	

Methodology <i>Comment on the correctness of the approach and/or the solution methods.</i>	correct
<p>Detailed analysis of the open profile ribs is clearly an area that will see great benefits, being the component most likely contributing to deficiencies in torsional performance. Optimising new ribs to achieve a balance of mass and rigidity whilst trying to maintain an AM production is an interesting study. Assessing the interfaces between the many parts is another area likely to yield improvements by mitigating compliances in the system assembly.</p>	

Technical level <i>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?</i>	A - excellent.
<p>This thesis demonstrates research and an understanding of the variety of readily available industrial solutions for many tasks, including motor and gearbox types, bearing assemblies, and additive manufacturing techniques. In assessment following the build it also acknowledges areas for design changes and further development to meet the specification.</p>	

Formal and language level, scope of thesis

D - satisfactory.

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?

This has been a challenging project encompassing a lot of development work which I know from being part of the project has not been justifiably covered here; and the difficulty of doing so in a limited document is acknowledged. For the benefit of a layperson, greater attention to explaining the context of the topics discussed would go a long way to assisting the readers comprehension of the project and understanding its achievements. The language is good though the content seems fragmented at times.

Selection of sources, citation correctness

D - satisfactory.

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?

Whilst there is little relevant documentation on previous SIT structures, some reference to previous work may have improved the appreciation for this projects explicit successes. The first four main references are only sited to on the first two pages with little indication to what content is being referred to. The list of abbreviations would have been useful at the beginning of the document rather than the end.

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.

It is challenging to fit such a large body of work into so few pages. It is clear that this has been a heavily design oriented task for a specific set of spatially constricting needs in the Atlas particle detector. However, comment on the production of the SIT and a full assembly photograph showing the results of all the efforts is a missed opportunity. The complete assembly makes good use of a range of industrial products, and reflections on the initial performance have also been met with new suggestions of how to solve them.

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

Summarize your opinion on the thesis and explain your final grading. Pose questions that should be answered during the presentation and defense of the student's work.

The grade that I award for the thesis is **B - very good**.

From my own participation in the project as coordinator for strip stave insertion I know that a great deal of attentive work has gone into the development of the stave insertion tooling mechanism, and that the mechanics of this prototype have performed well for us to test insertions on our full mock-up. The work here directly contributes to a high profile international research project in a significant way as it is responsible for installing £25M worth of stave detectors for the new Atlas particle detector.

The rationale to designing the assembly has been covered in great detail at many levels, with evidence of comprehensive market research that justifies the decisions taken. The successful build and testing of the tooling deserved more focus, but the important lessons learnt have shown to have been acted upon with the substantial redesign of key areas and analyses to back up the modifications.

For the deformation analyses, please clarify the reasoning for the directions and magnitudes of the forces applied and about how they are representative for cases that could be seen during the insertion procedure. Also explain the reasoning for using the chosen number of minimum support legs and the consequences to stave insertion if this were not followed.

Assessing this as a standalone document without drawing on the additional project exposure I have had, I give this the overall B grade. Thank you Jan and well done for all your hard work.

Date: 4.9.2022

Signature: 