

**I. IDENTIFICATION DATA**

<b>Thesis name:</b>	<b>AcouMan — akustoforetická manipulační platforma</b>
<b>Author's name:</b>	<b>Matouš Josef (457195)</b>
<b>Type of thesis :</b>	master
<b>Faculty/Institute:</b>	Faculty of Mechanical Engineering (FME)
<b>Department:</b>	Department of Control Engineering
<b>Thesis reviewer:</b>	Asier Marzo
<b>Reviewer's department:</b>	External – Computer Science, Public University of Navarre (Spain)

**II. EVALUATION OF INDIVIDUAL CRITERIA**

<b>Assignment</b>	<b>challenging</b>
<i>Evaluation of thesis difficulty of assignment.</i>	
<b>The difficulty of the task is considerable, especially for a master's level. I think a PhD would have problems solving it. At least the objects are floating on water, so the control system does not need to be ultra-fast.</b>	

<b>Satisfaction of assignment</b>	<b>fulfilled</b>
<i>Assess that handed thesis meets assignment. Present points of assignment that fell short or were extended. Try to assess importance, impact or cause of each shortcoming.</i>	
<b>I think the presented thesis addresses all the problems of this multi-faceted problem. It has electronics, computer vision, control algorithms, modelling, optimization. It is a very complete and satisfactory thesis.</b>	

<b>Method of conception</b>	<b>outstanding</b>
<i>Assess that student has chosen correct approach or solution methods.</i>	
The methods seem beyond the basic tools used by engineers. I am not an expert on control algorithms (beyond basic PID).	

<b>Technical level</b>	<b>A - excellent.</b>
<i>Assess level of thesis specialty, use of knowledge gained by study and by expert literature, use of sources and data gained by experience.</i>	
Not many references are used, but the ones included are used by the student as inspiration. I like seeing the thesis as an evolution of previous work to achieve a significant result that goes beyond what was previously achieved. The assembly of the triangles is really nice.	

<b>Formal and language level, scope of thesis</b>	<b>A - excellent.</b>
<i>Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.</i>	
I have not detected a single typo; it is well written and very understandable.	

<b>Selection of sources, citation correctness</b>	<b>A - excellent.</b>
<i>Present your opinion to student's activity when obtaining and using study materials for thesis creation. Characterize selection of sources. Assess that student used all relevant sources. Verify that all used elements are correctly distinguished from own results and thoughts. Assess that citation ethics has not been breached and that all bibliographic citations are complete and in accordance with citation convention and standards.</i>	
The reference section seems good, the main references from the field are included.	

<b>Additional commentary and evaluation</b>
<i>Present your opinion to achieved primary goals of thesis, e.g. level of theoretical results, level and functionality of technical or software conception, publication performance, experimental dexterity etc.</i>
Please insert your commentary (voluntary evaluation).

### III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

*Summarize thesis aspects that swayed your final evaluation. Please present apt questions which student should answer during defense.*

I really enjoy the thesis. It is very complete: electronics, microcontrollers, FPGAs, RPi, computer vision, control systems, radiation forces, acoustics... what else could be there? And all the aspects are combined towards a novel application. The assembly example is the perfect culmination of the thesis. Not much to add, just keep on with the good work.

I attach some questions:

- "I have built a pool with 3D-printed walls"

Why not buying an acrylic container? or building one with acrylic cement. How is it transparent if it is 3d printed?

- "which are then amplified to 16 Vpp by the shield."

What was the IC employed for this?

- Now you are only changing the phase. Do you think adding also amplitude control would provide any benefit?

- "The phase of the acoustic pressure has no observable effect on objects placed in the field. It is, therefore, sufficient to consider only the amplitude."

For regular focal points or twin-traps, phase does not do much. But acoustic vortices can transfer orbital angular momentum. Perhaps could be a future research direction for you, using vortices to rotate the objects.

- "Figure 3.4: Results of algorithm benchmarking. The dashed lines go through medians, the error bars span from minima to maxima."

LM is faster than BFGS, but perhaps BFGS gives larger amplitudes? I mean, execution time is an important metric, but the main metric could be amplitude at the focal points. Anyway, perhaps you may enjoy IBP which is a simple and fast method for generating multiple focal points (or other shapes) <https://www.pnas.org/content/116/1/84>

I evaluate handed thesis with classification grade **A - excellent**.

Date: **31.5.2020**

Signature: