

# Assessment of Bachelor's Thesis as an External Examiner

Title: **Manipulátor pro přepravu vozidel**

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External examiner: **Dr. Gaël Écorchard, ČVUT**

## **Fulfilment of Assigned Tasks**

The assigned tasks are mostly fulfilled. The supervisor's expectation was the design of a complete system but the student managed the development of the part concerning catching the car tyres and some initial tests on the actuation part of the lifting system. The student affirms that a global structure was developed but there is no drawing or picture of this structure. The development of a control system is also not complete since the code developed by the student concerns solely driving height servomotors at once on one side and the linear actuator through serial communication on the other side. There is a substantial work on the mechanical side, though.

## **Resolution Methods**

The student describes also developments and tests that were conducted but unsuccessful. This is a good thing according to me but the reasons why the first version of the tyre-catching mechanism is not practical are not related to the carried-out tests but from facts that were known beforehand. The principle of the first version of the tyre-catching mechanism is not described at all so it cannot be assessed whether rods in V-shape rather than parallel would allow to leverage the mentioned constraint on high accuracy of the mobile part. As far as the control system is concerned the student describes a system based on a micro-controller and a single-board computer but there is nowhere mention of the reason why a single-board computer is needed at all. The computation of the required torque on each of the height servomotors assumes that the servomotors have to lift the car. This is however not true since the principle is that the rods rotated by the servomotors catch the tyres from the sides and the required torque depends on the horizontal and vertical position of the rods relative to the tyres.

## **Obtained Results**

A lot of results were obtained but I am missing some more factual presentations of these results. The fact to use the potentiometer of servomotors as position feedback is highly interesting but it could have been exploited to prove the assertion that the servomotors handle the required torque. The student also assesses the rigidity of the global structure as non sufficient. The student affirms that a flexible structure cannot be used because this would require stronger linear actuators for the elevation. There is however no relationship between the flexibility of the structure and the force required to lift it, which is solely depending on its weight.

## **Practical Requirements**

As a non-native speaker I cannot assess the correctness of the language but I for sure know that expressions such as "13 kilo", "vteřínák", or "jsem koukal" do not appear as appropriate in such a manuscript. The pictures are of good quality apart from the hand-made drawings which are practically undecipherable. The pictures are not cited in the text.

Given the fact that the work concerns mostly mechanical implementation most of the references are adequate. However, none of the reference is cited in the text and reference [1] is out-of-topic. The names of all authors should be given in the reference list. The most relevant source for this work is the robot from Stanley Robotics but, except from the fact that it lifts the car from under the car, the working principle of this robot is not explained.

As a general comment, a lot of text is too long and is sometimes not technically sound. The two page description of servomotors could have been shortened to a maximum of one paragraph. The description of the different sort of batteries, especially the ones that are obviously obsolete, appears to me to be out-of-topic, given the fact that the project is not mobile yet. The description of the existing single-board computers as well as the communication between this single-board and the micro-controller is also useless because, at first, it is nowhere described why the single-board computer is required and, secondly, the best communication mean is not stated.

### **General Comments and Conclusion**

Most of the goals of the thesis were achieved but the integration of individual results remains to be done. The developed concept, though quite easy, seems to be functional. There is however no evidence that the system can be used as the manner to prove that the torque developed by the servomotors is sufficient is incorrect. The student affirms that a holding construction has been built but there is no evidence of it in the text, so that it cannot neither be assessed that the complete tyre-catching mechanism works as expected. The locking mechanism is also particularly badly presented as the reader has to guess by himself how it is supposed to work, there is no word about the actuation of the nails, the locking system appears to me to be over-dimensioned and the way the nails were cut are not mentioned.

During the oral presentation, I would wish the student to explain or give further details about the following points:

- explanation of the complete control system and the requirement on each part
- computation of the required torque on the servomotors
- computation of the required forces on the locking system
- details on the actuation of the locking system

As a conclusion, I advise the commission to evaluate the presented bachelor's thesis with the grade

**C - Good.**

Prague, January 27, 2020

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