



## Bachelor thesis opponent's review

**Master thesis:** Yaw stabilization of 4 Wheel Steering Cars

**Author:** Jiří Minarik

**Thesis supervisor:** Ing. Denis Efremov

**Thesis opponent:** Ing. Petr Liškář

Rating (1 – 5)  
(1 = best; 5 = worst):

1. Fulfillment of assignment requirements:	<input type="text" value="1"/>
2. Systematic solutions of individual tasks:	<input type="text" value="1"/>
3. Ability to apply knowledge and to use literature:	<input type="text" value="1"/>
4. Thesis formal and language level:	<input type="text" value="2"/>
5. Thesis readability and structuring:	<input type="text" value="3"/>
6. Thesis professional level:	<input type="text" value="2"/>
7. Conclusions and their formulation:	<input type="text" value="1"/>
<b>8. Final mark evaluation (A, B, C, D, E, F):</b>	<input type="text" value="B"/>
<b>verbal:</b>	very good

### Brief summary evaluation of the thesis (compulsory):

Given Bachelor thesis fulfills all necessary formal aspects and assigned requirements. It is relatively well structured, but selected form of references is impractical and reader-unfriendly and the language level is a matter to be improved.

The author had to deal with a non-trivial task of a four-wheel-steered vehicles and have elaborated and compared multiple different methods. The advantages, limitations and impacts of each of them were described and the reviewer has no doubt the student understood the topic very well.

Some part could have been done better, however. Front tire slip control test chapter does not show the plots demonstrating controller impact on the slip angle. Yaw rate without vehicle side slip angle is not sufficient to evaluate the vehicle lateral motion.

Sadly, clear mistakes in otherwise basic statements and trivial definitions undermined professional level of the thesis. For example, definition of the yaw moment as its direction is upwards, is wrong. The statement that the moment  $M_z$  is dependent on the force  $F_y$ , while both have the same origin is not correct either, and also understeering and oversteering definitions of the vehicle are confused multiple times.



The opponent would recommend to invest more time in reviewing even the trivial parts of the thesis.

**Questions:**

1. Could you demonstrate and comment the differences between understeering and oversteering vehicle?
2. What is the impact of the 4WS on frictional forces in the corner?

Date: 9<sup>th</sup> June 2019

Signature: Petr Liškář

**Notes:**

- 1) The total thesis evaluation needn't be determined by the partial evaluations average.
- 2) The total evaluation (item 8) should be from the following scale:

excellent	very good	good	satisfactory	sufficient	insufficient
A	B	C	D	E	F