REVIEWER'S OPINION OF FINAL THESIS

I. IDENTIFICATION DATA

Thesis name:	**Using an embedded QP solver for automotive applications**
Author's name:	**Rutrle Tomáš**
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Control Engineering
Thesis reviewer:	Ing. MSc. Martin Klaučo, PhD.
Reviewer's department:	Institute of Information Engineering, Automation, and Mathematics, Slovak University of Technology in Bratislava

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment — **ordinarily challenging**

Evaluation of thesis difficulty of assignment.

I find the assignment moderately challenging, since the basic principle of incorporating QP solvers on embedded platforms are available. I view in a positive way the concept of data exchange between several environments to solve QP problems.

Satisfaction of assignment — **fulfilled**

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.

The student has addressed all tasks from the assignment in the thesis.

Method of conception — **correct**

Assess that student has chosen correct approach or solution methods.

In general, the chosen methods to derive the quadratic problems and review of applicable communication busses in automotive domains. I see minor shortcomings in the Section 2.2, where the student should have explored the MPC formulations in more detail, since a particular MPC/QP formulation has direct impact on how many variables are passed via the bus.

Technical level — **Choose an item.**

Assess level of thesis specialty, use of knowledge gained by study and by expert literature, use of sources and data gained by experience.

Please insert your commentary.

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

Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.

The level of written English language is appropriate for a master level student; however, the thesis contains several mediocre and strange sentences, that seem to be directly translated from Czech. The length and the scope of the thesis is adequate to the master level student.

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

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.

The thesis contains suitable set of references, including top-level scientific papers and other practical publications. The student has included wide range of literary sources.

Additional commentary and evaluation

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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.
Further, I state some other comments: • References to equations, figures and tables must be written in parenthesis, not as standalone numerals. • Some parts of the thesis are inconsistently written. The student has mixed variable definitions in several cases, like the vector u in (2.7) is not the same vector as in (2.13). • MPC formulation in (2.27) is missing correct set of initial conditions, the Δu_k is not initialized for $k = 0$.

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.

In general, I find the thesis of good quality with focus on detail. The topic of incorporating MPC in automotive domain is of vital importance in of both, scientific and application level.

Questions for the student:

1. What is the role of the P matrix in (2.10)? What are the requirements for choosing the matrix P? Can we choose arbitrary positive definite matrix, and will it play its supposed role?
2. What would happen to the MPC derivation in (2.22) if the linear system contains non-zero direct feed-trough matrix D?
3. Did you consider a sparse reformulation of the MPC problem to the QP? What would be bottlenecks in this application?
4. What is the minimum response time of the CAN bus? Is it actually feasible to use this network to transfer optimal control actions in allotted sampling times?
5. What is reason for constraint violation, around time t = 23s on the velocity in the Figure 6.9, especially in a situation where the torque value did not reach it maximum value.

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

Date: **4.6.2022** Signature: Martin Hanzo