

I. Identification Data

Title:	Modeling and Control of an Advanced Turbocharging System
Author:	Ankit Singh Rawat
Thesis Type:	diplomová
Faculty:	Fakulta strojní (FS)
Department:	Automotive, Combustion Engine and Railway Engineering
Thesis Supervisor:	Prof. Ing. Jan Macek, DrSc.
Department:	Center of Vehicles for Sustainable Mobility

II. Thesis Assessment

Thesis Topics	Interdisciplinary, requiring broad knowledge, extraordinary demanding
The thesis topics have been defined together with Honeywell control department. The topics have required the combination of specific ICE feature description and control engineering simplification, aiming at model based control of turbocharging systems with an e-charger.	

Assignment Fulfillment	Fulfilled
The assignment of the thesis has been fulfilled by the search of available published models, development and testing the model and applying it with a simple control strategy to assess the effects of turbocharger degradation processes.	

Student's Approach and Activity during Thesis Elaboration	C - Good
Student visited preferentially the consulting persons at Honeywell. It was natural due to necessary compatibility with Honeywell used methods but it caused the use of some obsolete methods in turbocharger modelling and the absence of corrections to turbine unsteady operation during pressure pulses, typical for current turbocharger turbines. The level of student's knowledge has been increased during thesis elaboration. In the last period of thesis elaboration he collaborated better with the supervisor. It has been reflected by repairing some initial errors in elaboration and better presentation of thesis results.	

Technical Professional Level	D - Sufficient
The student's level has been significantly increased during thesis elaboration but still there are some gaps in applying the physical features of modelled systems to simplified models for control. In some cases it is caused by applying Honeywell procedures for engine piston part modelling. The needs of calibration to engine experiment or higher level simulation results are not respected fully in the thesis. It is visible especially in the approach to turbine maps, which cannot be used from standard steady-flow test rig in the case of pulsating flow. Although the appropriate simulation might have been out of student's abilities, the issue should have been mentioned in the text of thesis. Except for this application of physical substance, the programming in MATLAB/Simulink was done at sufficiently high level. There are many inaccuracies in general statements in the introductory part of thesis (e.g., GHG emissions are caused by the use of products of automotive industry for mobility, not by automotive industry itself, etc.). It might have been caused by the language inabilities and lack of time for thesis elaboration but it reduces the professional level of thesis. The impact of turbocharger parameter degradation on operation results depends significantly on control strategy, which is not mentioned in the text, and it will be reflected by engine efficiency and emissions.	

Formal and Language Level	E - Sufficient
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Formal and language level is poor despite repeated discussions with the supervisor, presenting the thesis contents at department meetings and correcting the found issues. The basic issue is a lack of well-structured presentation. Typically, duplicated presentation of the same facts (e.g., equations) from different sources with the same contents but expressed in different forms causes misleading information for the reader (e.g., the equations 2.2.5, 2.2.35 from literature sources and 4.3.3.1 are the same but not critically evaluated; moreover, 2.2.5 contain huge error in numerical constant). The same is right for figures - much information is duplicated but only the last occurrence is useful, e.g., Fig. 15 and 23 are fully suitable, Fig. 14 seems to use parallel e-charger, which is obviously not right and Fig. 23 would be enough. The duplicated information is sometimes confusing, sometimes even misleading.

It would be reasonable to present the list of symbols an alphabetic order and to add units to any symbol, because some equations in text cannot be used without this knowledge. It would, e.g., avoid the fact that sometimes power end energy (kW and kWh) are mismatched in graphs.

Some mistakes were caused perhaps by insufficient time devoted to thesis writing, e.g., Fig. 13 is a compressor map but it is described as turbine one.

Literature Search, Correctness of Citations

E - Sufficient

The search for literature sources was done according to supervisor's knowledge in broader range but not all of them are referred to **and used** in the text of the thesis. Nevertheless, no citation ethics problems are present in the thesis as it is submitted because the other sources have not been used for thesis elaboration. The formal correctness of references is not good, the full information of the source is frequently missing and internal sources are preferred instead of public access sources.

Other Comments

III. Resulting Assessment and Grade

The topics was extraordinary demanding for a student with general automotive and ICE background. The student's approach has been very valuable and his expert level has been increasing during the time of thesis elaboration. His "stubborn" seeking for better knowledge should be highly appreciated. On the other hand, his application of real engine physics to simplified control systems features still some gaps. Although the thesis contains many errors in details, sometimes perhaps caused by presentation issues, the results can be used with appropriate calibration as a step towards model-based control system. That is why my assessment is at the grade of D.

I propose the resulting grade

D - satisfactory

Datum: 26.8.2018

Podpis:

