Classification of Diploma Thesis – supervisor

Author of classification:	Sebastian Basterrech, PhD.
Supervisor:	Sebastian Basterrech, PhD.
Opponents:	prof. Ing. Radim Halama, Ph.D.
Title:	Calibration of Advanced Material Model for 3D Printing Materials using Optimization and Machine Learning Methods
Thesis version:	1
Student:	Avinash Musiri Ramalingam Pillai Baskar

1. *Achieved results*

   The student presents the analysis of the calibration of model parameters for a specific material (3D printed stainless steel SS316L). It was studied the following models: Armstrong-Frederic, non-linear isotropic hardening model and Chaboche model. For the first two models the studied applied well-known techniques and tools related to the advanced material model area. The interesting approach comes from the calibration of Chaboche model, where the student applied Neural Networks. For the adjusting of the Neural Network model the student created a simulated dataset. The presented result has limitations (it requires a larger dataset for obtaining more reliable results), however the global applied methodology is interesting and it can be applied in the near future by other students and/or researchers on the area.

2. *Problematics of thesis*

   The studied topic is relevant to the area. The thesis required good knowledge on advanced material models and the software used for model calibration. Furthermore, the student needed to face at least the following additional difficulties:
   To deal with a large amount of data. The training of the Neural Networks required big data, which was hard to be processed in the personal computer of the student.
   To became familiar with Machine Learning techniques, it was a new domain for the student.
   To became familiar in a language as Python that was also new for the student.
   Scheduling and planning. The student started the thesis rather late, for the thesis characteristics (required a lot of implementation time and new concepts) would be better to be working for a larger amount time.

3. *Student's proceed to work at thesis*

   The work it wasn't regular and continuous as it is suitable. However, during the last month the student increased the effort and working time, and he arrived to submit an acceptable Master thesis.

4. *Formal essentials of thesis*

   The thesis presents some written problems (related to form, also it has typos). It could be presented in a higher quality condition. Although, it is acceptable for a Master student, mainly considering the additional difficulties of the thesis mentioned above.

5. *Questions to student*

   1) Describe the creation of the simulated data that was used for training the Neural Networks (NNs).
   2) What are the advantages of the selected two NNs (ESN and ELM) with respect of other NN models?

6. *General revaluation of thesis*

   The main objectives in the thesis were covered by the student. The document presented by Mr. Avinash Ramaligam Pillai Baskar has the level and content according to a Master thesis. It presents an original methodology using Machine Learning approaches for calibrating the parameters of Chaboche Model. The method can be easily adapted to other materials, as well as to other models. The results are not good as expected (if we compare with other traditional optimization techniques), probably because the student didn't reach the optimal architecture of the neural networks. However, it is extremely hard to reach optimal architectures due to the large amount of data and low computational resources of the students. In spite of that, the most interesting contribution is the presented methodology that can be done by any other researcher on the future with better computational resources. As a consequence, I believe the presented work has the level of a Master thesis with a mark of GOOD.

Overall classification: good

Ostrava, 11.08.2020

Sebastian Basterrech, PhD.