

Opponent Review of Doctoral Dissertation

Applicant: Jan Koudelka

Title of Dissertation: Stability Issues in Modern Power Systems

Opponent: Prof. Robert Schuerhuber

Opponent's Department: Institute of Electrical Power Systems, Graz University of Technology, Austria

In accordance with the Study and Examination Rules of BUT, in his/her review the opponent will mainly comment on:

- a) the topicality of the dissertation,*
- b) whether the dissertation achieved its given objective,*
- c) the problem-solving procedure and the results of the dissertation along with the concrete contribution of the doctoral student,*
- d) the significance for practical application or the progress in the field,*
- e) formal and language qualities of the dissertation,*
- f) whether the dissertation fulfils the conditions of Section 47 (4) of the Act,*
- g) whether the student proved his/her creative abilities in the given research field and whether the work does or does not comply with the standard requirements placed on the dissertations in the given field. The review is not valid without this conclusion.*

It is necessary to add a concise commentary to each of the points below.

Ad a) Topicality of the dissertation

The topic of the dissertation is very topical.

Comment:

In general, the stability of energy systems is a highly topical and important issue. Mr. Koudelka highlights some specific aspects in his work, but these are somewhat disjointed and the results lack a common thread.

Ad b) Objective of the dissertation

The objective of the dissertation was achieved.

Comment:

The results are largely obtained from simulations, mostly based on existing models and scenarios. A more detailed presentation of the theoretical background would be desirable. It is also often not easy to deduce the author's new contribution to the topic.

Ad c) Problem-solving procedure and the results of the dissertation and the concrete contribution of the doctoral student

The problem-solving procedure and the results of the dissertation are above average.

Comment:

The methodology is sufficiently well presented and the results clearly summarized. The conclusions could be elaborated more precisely, e.g. the way in which the results can be generalized could be worked out. As a non-Czech speaking opponent I have to criticize references to literature available only in Czech.

Ad d) Significance for practical application or progress in the field

The significance for practical application or progress in the field is above average.

Comment:

The results form a good basis for initiating further research and support the analysis of this practically important topic.

Ad e) Formal and language qualities of the dissertation

Formal and language qualities of the dissertation are above average.

Comment:

Linguistically, the work is of a high standard.

Ad f) The dissertation fulfils the conditions of Section 47 (4) of the Act

The dissertation fulfils the conditions of Section 47 (4)*) Act No. 111/1998 Sb. Higher Education Act: YES

*(*4) Studies are duly finished with a doctoral state exam and dissertation defence, which prove the ability and readiness to work independently in the field of research or development, or in theoretical and creative arts. The dissertation must comprise original and published results or results accepted for publication.*

Ad g) Creative abilities of the student in the given research field. Compliance with the standard requirements placed on the dissertations in the given field.

The doctoral student did prove his/her creative abilities in the given research field and the work does comply with the standard requirements placed on the dissertations in the given field.

Comment:

The aspects of frequency support and dynamic stability are treated from several different points of view, showing the broad knowledge of the doctoral student and also his ability to tackle problems from different sides, which is a proof of ability to creatively solve complex problems in the field of power engineering.

Overall evaluation: The work analyses selected aspects of a current topic and develops some new findings. I therefore recommend the dissertation for a defence.

Opponent's questions:

Paper 1 (On direct calculation of the Critical Clearing Time):

- Please comment on the reasons why the results for the different methods investigated yield different results? What is the relevant difference in modeling concerning the CCT?

Paper 3 (Transient Stability Assessment for Unbalanced Faults):

- Please comment why the investigation of balanced three faults is not sufficient for stability assessment. Are there any cases for which an unbalanced fault leads to a worse situation concerning stability?

Paper 3 (Methods for Dynamic Stability Assessment):

- Please explain the physical background of equations (4) and (5), which are the basis for Ljapunov method.

Paper 4 (Factors Affecting Transient Stability Simulation Possibilities in PSCAD und MODEs):

- Comment on the influence of the described parameters (A-E) on the CCT. Which of these have to be modelled in detail, which can be neglected and why? Please check the difference of mechanical time constant of round rotor machines and salient pole machines.

Paper 5 (Simplified Dynamic Model for Continental Europe Synchronous Area Separation):

- How is the inertia constant of the generator model obtained? Comment on the influence of AVR, PSS, machine parameters on the result.

Paper 7 (Use of new means for frequency support of power system in emergency state):

- Fig. 6: Explain the difference between the blue and green curve. It seems that ROCOF is not effected by including electric vehicle charging in frequency support. What would have to be done in order to decrease ROCOF?
- How does the inclusion of electric vehicle charging in frequency support interact with FCR?

I recommend do not recommend the dissertation for the defence.

Date: 20.03.2024

Signature:

