Annex No. 10 to the MU Directive on Habilitation Procedures and Professor Appointment Procedures

HABILITATION THESIS REVIEWER'S REPORT

Masaryk University	
Applicant	RNDr. Lenka Přibylová, Ph.D.
Habilitation thesis	Applied nonlinear dynamics
Reviewer	Petr Stehlík, doc. RNDr. Ph.D.
Reviewer's home unit, institution	University of West Bohemia

The habilitation thesis of Lenka Přibylová deals with applications of the bifurcation theory to a wide range of dynamical systems. Roughly speaking, it is divided into three parts. First, there are four chapters describing several topics of bifurcation theory and their relationship to the author's recent results. Next, the original files of these publications of Lenka Přibylová are included and fill most of the pages of the thesis. Finally, recent manuscripts dealing with covid-19 modelling are included as an attachment.

The reader of the thesis or the published papers does not need much time and effort to conclude that the work of Lenka Přibylová is truly original. The constant need to study problems which are motivated by questions from applications permeates the whole text and the attached papers. The number of results and their technical depth may be below average standards of habilitation theses in Czechia, but I strongly appreciate the effort to reach to other scientific areas and try to break the ubiquitous isolation of individual disciplines in the Czech scientific community.

Naturally, this is a difficult and dangerous endeavour and the results in the thesis differ, in my opinion, in the degree of relevance to applications. I am a bit sceptical about the four older papers dealing with economic models. I am afraid that they are not directly relevant to recent economic standards, the journals in which the papers appeared indicate as well that they rather represent a dynamical systems point of view. Bifurcation analysis of ODE models, i.e., in continuous time, and without data verification is rather rare in the recent mainstream mathematical economics for numerous reasons. In contrast, the recent papers in mathematical biology fit perfectly the high standards of top research in the area. The papers include the detailed analysis of various modifications of key models coupled with a thorough description of advanced dynamic.

It is understandable that mathematically the tools differ significantly in the thesis and range from those which are rather standard (one-dimensional bifurcations) to those which correspond to the pressing open questions in dynamical systems theory (e.g., synchronization).

The originality of the author is also reflected in the style and presentation. The text is far from the dry and minimalistic mathematical standards. I enjoyed reading the introductory part even the sections which I had been familiar with. The different contributions of the author in

various fields are often nicely introduced by non-standard forms (“plink, science, plink, science…”) and unusual grammar forms (“If you don’t believe me, look in [38]”). I appreciate such refreshing originality despite some minor objections to formal deficiencies (e.g., missing figure captions in Ch.4), inconsistencies (especially in the bibliography) or in the contrasting approach to individual chapters (indeed, I would like to go through a more detailed broader picture in Ch. 5 as in the previous chapters).

Reviewer's questions for the habilitation thesis defence (number of questions up to the reviewer)

1. The thesis discusses in detail numerous applications in mathematical biology and mathematical economics. At the first sight, the reader may have an impression that the relationship of dynamical systems to biology on the one hand and economics on the other hand is the same. Could you discuss the crucial differences between applications of dynamical systems in mathematical economics and biology, let alone in physics?

2. I understand that unpublished papers should not be included in habilitation thesis but I wonder why the published papers dealing with covid-19 pandemics have been relegated to the attachment. Wouldn’t they perfectly fit the topic of the thesis Applied nonlinear dynamics?

3. I am deeply curious about the next projects of the author. How has the broader questions and approach to research been modified after recent work with real world data and wide range of scientists from different fields and cultures? Has her view of the role of mathematics in applications been significantly revised?

Conclusion

The habilitation thesis entitled “Applied nonlinear dynamics” by Lenka Přibylová **fulfils** requirements expected of a habilitation thesis in the field of Mathematics – Applied Mathematics.

Date: 13th January 2023 Signature: