

## PUBLIC LECTURE EVALUATION

### Masaryk University

<b>Faculty</b>	Faculty of Science
<b>Procedure field</b>	Mathematics – Applied Mathematics
<b>Applicant</b>	RNDr. Lenka Příbylová, Ph.D.
<b>Lecture date</b>	14. 2. 2023
<b>Lecture topic</b>	<i>Applied nonlinear dynamics – abrupt changes in dynamics</i>
<b>Persons present</b> (number)	36 / 8 (on-site / online)
<b>Designated evaluators</b> (board members)	Prof. Aleksandre Lomtadze, DrSc., Faculty of Mechanical Engineering, Brno University of Technology (on-site) Prof. RNDr. Jan Slovák, DrSc., Faculty of Science, Masaryk University (on-site) Prof. RNDr. Zdeněk Pospíšil, Dr., Faculty of Science, Masaryk University (on-site)

### Course of the lecture

Jan Slovák introduced the members of the habilitation board (3 on-site, 2 online) and the two reviewers (prof. Meijer, prof. Fečkan) of the habilitation thesis by Lenka Příbylová (both of them online). Then he summarized some important points from the applicant's CV.

The public lecture discussed mechanisms of abrupt changes emergence and their relation to bistability and folds (limit points) of the attractor manifolds. Lenka Příbylová discussed possible limit point detection methods for different types of attractors, typical phenomena and applications related to folding of attractor manifolds such as hysteresis, switches (in biochemical, ecological, eco-evolutionary models), mechanisms and types of neuronal spiking, synchronization in a superconductive circuit of Josephson junction or coupled networks of neuron models. The presentation covered the applicant's published articles as well as current research and future research directions; the research applicable in ecology and eco-evolution was highlighted, in particular.

### Questions from the opponent's report by prof. Hil G. E. Meijer:

1. On page 40–41, the applicant says that some numerical aspect in the model is stiff. To me, it is unclear where this stiffness appears. Stiffness leads to small steps in parameters for example as the numerical problem is sensitive. This also appears on page 247, but harmonic terms are not stiff per se. Rather they present a challenge as a proper method has to be formulated that can be solved numerically. Can she explain the numerical problem, state how it is stiff, and how her approach solves this?

# M U N I

2. On p120, figure 5 of [Hajnova&Pribylova, 2017], there is a dashed line emanating from the Chenciner point [CH] turning at the Cusp [CP] and terminating at R2. While this is theoretically a correct scenario, finding this line numerically is extremely challenging. The use of MatContM in this chapter and the specification of the numerical values warrant the credibility of all local bifurcation curves, and the existence of the global bifurcation curves near the R2 and CH points. Further away this is not clear at all. Can she comment on the numerical methods used to determine the precise shape of the “fold bifurcation of loop”-curve? A follow-up question is that this saddle-node bifurcation of invariant curves is a quasi-periodic bifurcation, which implies that the bifurcation set is fractal and very complicated. Is it correct to present this as a “simple” curve?  
A related question is how the applicant sees the reproducibility crises in Science? How should we publish our methods? How should you teach and work with the students?
3. In applications of the SEIAR model, the novel asymptotic class A is introduced and I believe this is a very interesting addition. An essential component is then to estimate parameters to see which fraction shows symptoms and which part does not. During Covid19 there was extensive sampling and more data. How could this model be applied other corona or influenza-type epidemics when the data is more scarce?

These questions were answered satisfactory, the rest of the questions from the report have been discussed with necessary technical details on previous on-line discussion between prof. Meijer and dr. Příbylová.

## Questions from the board

4. Which software have you used for visualizations?
5. Do you think that your Covid models are better than hundreds of proposed ones? The more models the better?
6. What are the connections between mathematics (dynamical systems theory) and machine learning?
7. Is it possible to unify the continuous and discrete theory? Something similar like in the stability theory.

All of the replies have satisfied the enquirers.

The lecture delivered by Lenka Přibylová, entitled “*Applied nonlinear dynamics – abrupt changes in dynamics*” and delivered as part of the habilitation procedure, **demonstrated** sufficient scholarly qualifications and pedagogical capabilities expected of applicants participating in a habilitation procedure in the field of Mathematics – Applied Mathematics.

The lecture took place in a hybrid form at 2–3:20 p.m. The above-mentioned members of the board attended the lecture and provided its evaluation. All designated evaluators are familiar with the text of the evaluation and agree with it.

Date: February 14, 2023

Aleksandre Lomtadze

Jan Slovák

Zdeněk Pospíšil