HABILITATION THESIS REVIEWER'S REPORT

Masaryk University	
Faculty	Faculty of Science
Procedure field	Mathematics – Mathematical Analysis
Applicant	Dr. András Rontó
Applicant's home unit, institution	Brno Technical University, Brno, Czech Republic
Habilitation thesis	"Parametrisation Methods for Constructive Analysis of Boundary Value Problems for Ordinary Differential Equations"
Reviewer	Alexander Domoshnitsky, Full Professor, Head of Mathematics Department
Reviewer's home unit, institution	Ariel University, Ariel, Israel

[Review text]
The thesis under review is based on 8 papers with a commentary. The commentary consists of four chapters which summarize the respective blocks of results.

The main topic is the constructive study of boundary value problems for systems of ordinary differential equations. The basic constructions are presented in Chapter I, where periodic and two-point problems are dealt with. The method of periodic successive approximations is developed, which can be used both for the study of the existence of solutions and for their approximate construction. The applicability of the method is proved under the assumption that the nonlinearity satisfies the Lipschitz condition on a bounded set. Among the rest, a novel feature here is that the approach turns out to be applicable for arbitrarily large Lipschitz constants, which is achieved using suitable interval divisions and subsequent gluing. This is an interesting idea which should be fruitful in other cases, in particular, for boundary value problems for more general equations involving argument deviations. This also seems to be a simpler and more universal way to guarantee the convergence when compared to the known Cesari method. The approach allows to obtain existence theorems of continuation type, with the possibility to formulate corollaries with effectively verifiable conditions.

The ideas described in Chapter I, with suitable modifications, are then used in other situations. It is shown that problems with general nonlocal conditions can be treated in a analogous way using the same kind of auxiliary boundary conditions (Chapter II). While the original boundary condition is not satisfied there automatically at every step, the use of the corresponding approximations is much similar to the periodic case, including the way to guarantee the convergence for large nonlinear terms. For the practical computation, an effective combination of this technique with polynomial interpolation is studied and justified under natural additional assumptions.

Approximate solution of boundary value problems for systems of ordinary differential equations with state-dependent impulses is discussed in Chapter III, where the approach using techniques from Chapters I-II is adjusted for this complicated class of problems. Another problem, where the approach under consideration turns out to be useful, concerns solutions of boundary value problems taking zero values at unknown points (Chapter IV). An

effective procedure allowing to treat this problem us constructed based on the techniques from Chapter II.

The thesis is well written. The works described in it contain interesting results obtained by the author using original ideas. In my opinion, the approach presented there has a nice perspective for development in other situations.

Reviewer's questions for the habilitation thesis defence

1. The main focus of the papers constituting the thesis is the study of ordinary differential equations. Are there similar results for functional differential equations, e.g. in the case of equations with argument deviations? The opportunity to obtain existence theorems similar to those from Chapter I would be very interesting.

Conclusion

The habilitation thesis entitled "Parametrisation Methods for Constructive Analysis of Boundary Value Problems for Ordinary Differential Equations" by András Rontó **fulfils** requirements expected of a habilitation thesis in the field of Mathematics – Mathematical Analysis.

I attended dozens of talks delivered by Andras Ronto on International conferences on differential equations and confirm his high level in differential equations and wide development in general areas of mathematics. All of his talks included new original ideas. His approaches based on them are efficient and could be developed in a future. His talks were built right from didactic point of view. Undoubtedly, he is suitable for Professor's position.

I strongly recommend him to position of Professor.

Date: 31/3/2021   Signature: