

Dissertation Review:  
“Demonstration-based Optimal Control of  
Nonlinear Systems”  
by Jiří Fejlek

Stefan Ratschan

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The core of the dissertation is based on the three publications listed below. It puts the publications into a common frame, adds underlying theoretical background, and gives more detailed comparison and justification of the results wrt. previous work.

The original results contained in these publications and described in this thesis improve the control method of LQR trees developed in the robotics community. The thesis introduces both theoretic and algorithmic improvements of the method. The theoretic improvements provide and prove stronger convergence guarantees than the ones described in the original publications. The algorithmic improvements contribute to the practical applicability of the method by increasing its practical efficiency and its usability in the presence of obstacles.

In all three underlying publications, the author order of these publications is alphabetic. However, J. Fejlek is clearly responsible for the major share of the contribution in all three cases.

As already mentioned, despite the keyword “optimal control”, the topic of the thesis “demonstration-based control” has been mainly developed by the robotics community, and due to this, our publication strategy followed the practice in this community, where some of the most important work is not published in journals, but in conference proceedings. More concretely, two of the three publications appeared in the proceedings of the two most prestigious conferences of the robotics community. The third paper is currently under revision in one of the most-prestigious journals of the control and automation community.

Based on this I declare that

*the dissertation clearly documents the ability for independent scientific work of the candidate J. Fejlek, and due to this, I strongly support its defense.*

## References

- [1] Jiří Fejlek and Stefan Ratschan. “Computation of Stabilizing and Relatively Optimal Feedback Control Laws Based on Demonstrations”. In: *arXiv preprint arXiv:2011.12639* (2021). submitted.
- [2] Jiří Fejlek and Stefan Ratschan. “Computing Funnels Using Numerical Optimization Based Falsifiers”. In: *2022 International Conference on Robotics and Automation (ICRA)*. 2022. pp. 4318–4324.
- [3] Jiří Fejlek and Stefan Ratschan. “LQR-Trees with Sampling Based Exploration of the State Space”. In: *2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. 2023. pp. 4777–4782.