

# PhD thesis proposal – 2026

- **Title: Stability of optimal control with long time horizon**

- **Research units:**

VADOR E105-04, TU Wien, Austria.

LMBA, UMR-6208, Univ Brest, France.

- **Theme:** Analysis, control theory.
- **Key words:** Nonsmooth Analysis, Optimization, Control Theory.

- **Names, emails, institutions of doctoral advisors.**

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## PhD Research proposal

This PhD project is focused on the optimal control of ordinary differential equations (ODEs). The objective is to identify a control input that minimizes a specific cost functional over a family of system trajectories. The Pontryagin maximum principle establishes necessary conditions for optimality. A central challenge –which is a key focus of this project– is to analyze the stability of the maximum principle’s results under perturbations of the initial data.

The proposed research concerns the investigation of the stability of the mentioned necessary conditions when the time interval where the problem is stated is very long. A typical example is the case when the cost is the (Cesaro) mean of a given function on a time interval  $[0, T]$  and the horizon  $T$  tends to infinity. This will be the starting problem of the thesis. Several other interesting questions will be investigated depending on the progress of the PhD student. Beyond the main focus, the project explores two additional areas. First, it investigates optimal control problems involving state constraints, where the regularity of solutions is a little-studied topic. Second, the research extends to non-convex cases; although stability in convex control sets is nowadays well understood,

the non-convex situation requires further analysis. The work may also consider connections with Hamilton-Jacobi-Bellman equations.

Since the maximum principle is expressed as a generalized equation whose stability is often analyzed using metric regularity, and considering that the resulting optimization problems are nonsmooth, the PhD candidate will need to understand and apply principles of nonsmooth and variational analysis to the field of optimal control.

This research project is part of the French-Austrian International Collaborative Research Project ANR SABOCPR / FWF PIN 4368225. The 3-year doctoral contract will be carried out at the TU Wien, Austria. It is expected that the PhD student spends half of his/her PhD journey at the TU Wien and the other half at the Université de Bretagne Occidentale, Brest, France.

## References

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- [4] Quincampoix, Marc; Scarinci, Teresa; Veliov, Vladimir M. On the metric regularity of affine optimal control problems. J. Convex Anal. 27, No. 2, 509-533 (2020).