

# Fixed point theorems

Bachelor thesis topic

**Supervisor:** Christian Bargetz ([christian.bargetz@uibk.ac.at](mailto:christian.bargetz@uibk.ac.at))

Fixed point theorems play an important role in nonlinear analysis. The aim of this thesis is to study a number of interesting fixed point theorems. Our journey starts with Brouwer's fixed point theorem which states that every continuous self-mapping of a bounded, closed and convex subset of Euclidean space has a fixed point. We then see that this is no longer true in infinite dimensions and see two generalisations of Brouwer's fixed point theorem to infinite dimensional settings: Schauder's fixed point theorem and the one of Browder-Göhde-Kirk.

As a generalisation of the classical fixed point theorem of Banach, we study Rakotch's fixed point theorem.

Depending on the interests, we may also study Nadler's fixed point theorem and its extensions or we delve into the fixed point property for nonexpansive mappings.

## References

- [1] Martin Aigner and Günter M. Ziegler. *Proofs from The Book*. Springer-Verlag, Berlin, fourth edition, 2010.
- [2] Kazimierz Goebel and Simeon Reich. *Uniform convexity, hyperbolic geometry, and nonexpansive mappings*, volume 83 of *Monographs and Textbooks in Pure and Applied Mathematics*. Marcel Dekker, Inc., New York, 1984.
- [3] Sam B. Nadler, Jr. Multi-valued contraction mappings. *Pacific J. Math.*, 30:475–488, 1969.
- [4] Ephraim Rakotch. A note on contractive mappings. *Proc. Amer. Math. Soc.*, 13:459–465, 1962.