

# Convex optimization problems inspired by geotechnical stability analysis

Stanislav Sysala<sup>1</sup>, Michal Béréš, Simona Béréšová, Jaroslav Haslinger, Jakub Kružík  
and Tomáš Lubér

<sup>1</sup> Institute of Geonics of the Czech Academy of Sciences

`stanislav.sysala@ugn.cas.cz`

**Abstract:** This contribution is motivated by the *limit load*, *limit analysis* and *shear strength reduction* methods, which are commonly employed in geotechnical stability analysis or similar applications. The aim is to make these methods more approachable by introducing a unified framework based on abstract convex optimization and its parametric studies. We establish suitable assumptions on the abstract problems that capture the selected features of these methods and facilitate rigorous theoretical investigation. Further, we propose continuation techniques tailored to the resulting parametric problem formulations and show that the developed abstract framework could also be useful outside the domain of geotechnical stability analysis. The main results are illustrated with analytical and numerical examples. The numerical example deals with a 3D slope stability problem. The research is supported by the European Union through the Operational Programme Jan Amos Komenský under project INODIN No. CZ.02.01.01/00/23\_020/0008487.

## References

- [1] S. Sysala, M. Béréš, S. Béréšová, J. Haslinger, J. Kružík, T. Lubér: *Convex optimization problems inspired by geotechnical stability analysis*. <http://arxiv.org/abs/2312.12170>, 2025.