An overview of computational limit analysis for civil engineering applications

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Limit analysis [**?**, **?**] (or yield design [**?**]) theory is an extremely efficient tool for estimating plastic collapse loads and has been at the origin of many hand-based procedures of civil engineering structural design (slope stability, strut-and-tie method, yield-line theory). With the advent of efficient mathematical programming solvers and dedicated finite element techniques, limit analysis computations can now be used to assess structural safety in a robust manner for many complex situations.

Relying on a FEniCS-based library for automating limit analysis computations, this talk will give an overview of its applications in civil engineering including complex 3D steel assemblies, masonry and reinforced-concrete elements, plate or shell-like structures, etc.

We will finally briefly show how conic programming solvers can also be used to extend classical limit analysis computations towards robust design or topology optimization.

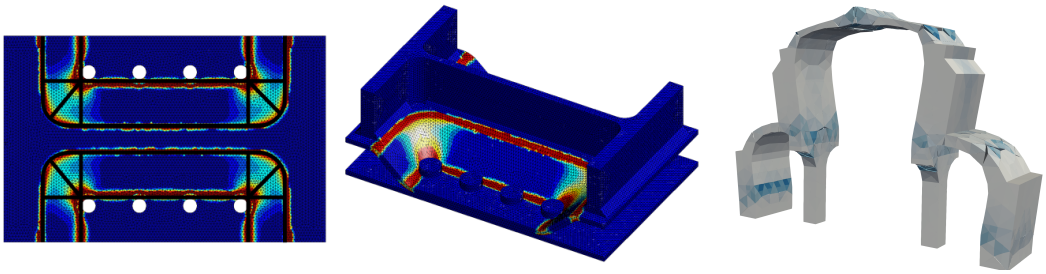

Figure 1: Collapse mechanisms and plastic dissipation of a bolted-steel connection (left) and a model of an abbey (right)

Short Bio

Jeremy Bleyer graduated from Ecole Polytechnique and Ecole des Ponts ParisTech in 2011 and obtained his PhD from Université Paris-Est in 2015. He is now a permanent researcher and lecturer from Ecole des Ponts ParisTech since 2017. His research topics focus on limit analysis theory, multi-scale techniques for heterogeneous materials and structures, phase-field approaches for brittle fracture with applications to civil engineering.

References

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