

# A nonsmooth program for jamming hard spheres

Peter Hinow

*Department of Mathematical Sciences, University of Wisconsin - Milwaukee*

We study packings of  $n$  hard spheres of equal radius in the  $d$ -dimensional unit cube. We present a nonsmooth function whose local extrema are the radii of jammed packings (where no subset of spheres can be moved keeping all others fixed) and show that for a fixed number of spheres there are only finitely many radii of such jammed configurations. We propose an algorithm for the maximization of this maximal radius function and present examples for 5 - 8 disks in the unit square and 4 - 6 spheres in the unit cube. The method allows straightforward generalization to packings of spheres in other compact containers. The origin of this research is a problem in pharmaceutical science on predicting the release kinetics of matrix tablets. This work has been partially supported by the US National Science Foundation through grants DMS 1016214.

## References

- [1] P. Hinow. A nonsmooth program for jamming hard spheres. *Optimization Letters*, to appear (2013). [arXiv:1209.4053](https://arxiv.org/abs/1209.4053)