Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Solving the Granular Inverse Packing Problem with Artificial Evolution MARC MISKIN, HEINRICH JAEGER, James Franck Institute, University of Chicago — If a collection of identical particles is poured into a container, it is obvious that different shapes will fill to different densities. But what is the shape that fills a container as close as possible to a pre-specified, desired density? We demonstrate a solution to this inverse-packing problem by framing it in the context of artificial evolution. By representing shapes as bonded spheres, we show how particles may be mutated, simulated, and selected to produce particularly dense or loose packing aggregates, both with and without friction. Moreover, we show how motifs emerge linking these shapes together. The result is a set of design rules that function as an effective solution to the inverse packing problem for given packing procedures and boundary conditions. Finally, we show that these results may be verified by experiments on 3d printed prototypes used to make packings in the real world.

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Date submitted: 15 Nov 2013 Electronic form version 1.4