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Kingdom Built on a Pile of Sand:Slow and Steady

Contents

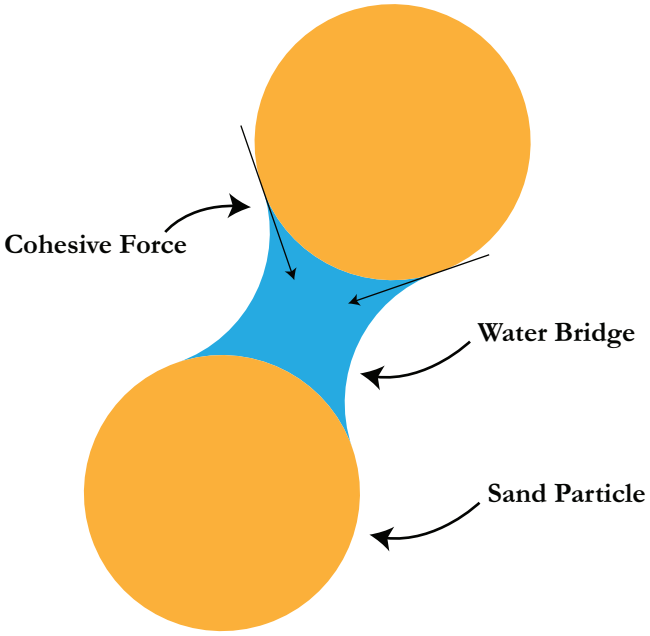

Figure 1: Water Bridge Between Sand Particle

1 Introduction

1.1 Problem Background

Sunshine, clear blue sea and golden color sand always seem to leave people in a happy state of mind. And a beach is where these three are combined, drawing people all around towards it. Sand, the granular matter formed by constant brushing of flowing water, however, can react with water in a different way, despite the fact that people refer to it as non-stable or unreliable. On a beach, where the already formed granular sand and the rise and fall of sea wave lies together, a new buff can be added to our flowing friend, a wetted state.

Magically but not randomly, sand gets sticky when combined with water, due to the most obvious physical theorem: surface tension and atmosphere pressure. From previous people's work, we've know that this buff comes from the water bridge formed between sand particles, which can significantly cluster together during the increasing water-sand portion[1]–[3]. Kudrolli and Arshad has visualized the bridge between sand like Figure 1.

And that's the magic that glue our favorite sand castle together, which is one of the most entertainment for enthusiastic beach goers. However, being built near the water that melts mud and our wet sand, all sand castles have to face the fate that they'll g et too wet to hold its own weight and the impact from sea waves. That's because the water bridge has another property of clustering together[3]. When you throw a pile of sand into water, they behave just as when they're completely dry, melting down like fluid. Thus beach castle builder might want to make their sand castle last longer than those build arbitrarily than others, which is also the purpose of this article.

1.2 Our Work

Normally people will sculpt their kingdom from a pile of tedious wet sand. To simplify the model and grasp main threads, we'll focus our research on this single, nondescriptive mound of wetted sand.

2 Assumptions & Nomenclature

2.1 Assumptions

2.2 Nomenclature

3 Modeling Under Waves and Tides

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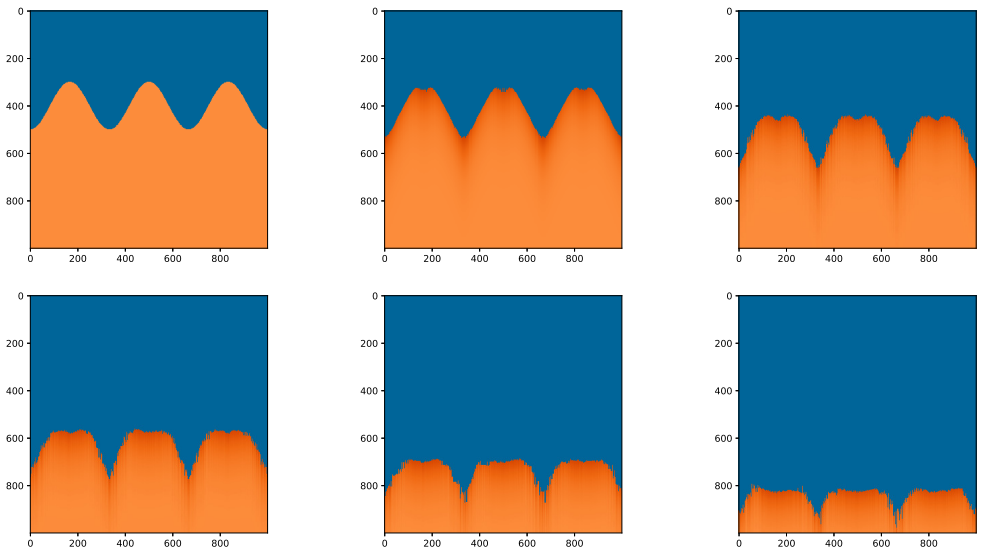

Figure 2: A Windows Terminal.

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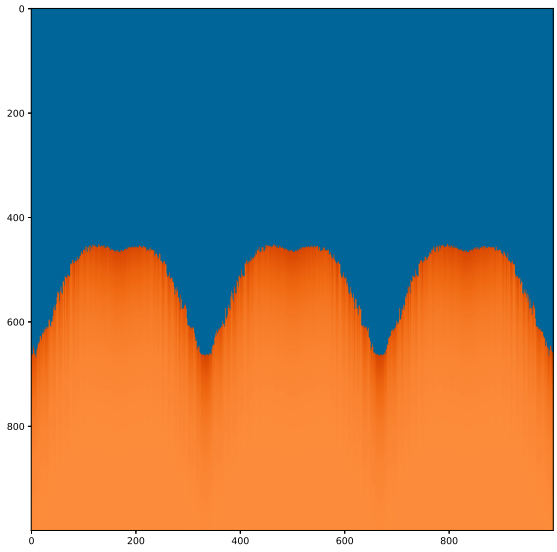

Figure 3: A Windows Terminal.

3.1 Shape of the Slope: Mohr-Coulomb Criterion

3.2 Top View Shape

3.3 Calculating Results

3.4 Simulating Results

This is some example text[1].

I'm referring to footnote 1.

4 Modeling Under Rain

5 Determine the Best Sand-to-water Proportion

6 Other Ways to Make Our Sand Castle Last Longer

7 Sensitivity Analysis

[1]Hello footnote

List of Figures

List of Tables

List of Listings

References

[1] M. Pakpour, M. Habibi, P. Møller, and D. Bonn, "How to construct the perfect sandcastle," *Scientific reports*, vol. 2, no. 1, pp. 1–3, 2012.

[2] N. Mitarai and F. Nori, "Wet granular materials," *Advances in Physics*, vol. 55, no. 1-2, pp. 1–45, 2006.

[3] A. Kudrolli, "Sticky sand," *Nature materials*, vol. 7, no. 3, pp. 174–175, 2008.