Math Wheels

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Abstract

In this paper, we reinvent the wheels.

1 Introduction

In this first section, we will derive what are the requirements for a wheel to "roll properly".

1.1 What is a wheel?

First, we need to rethink the concept of a wheel. What makes a wheel convenient? The fact that it rolls, of course. But other shapes could roll, e.g. a non-circular oval. However, on a flat surface, oval wheels would not be convenient. The principal reason for this is that the height of the rotation axis would not be constant as the wheel turn.

Thus, we decide to define the requirement for a wheel to "roll properly" to have a rotation axis constant.

Let us define this mathematically: We take a general wheel shape given by its (positive) radius for all angles $r(\alpha) \in \mathbb{R}^+ \quad \alpha \in [0, 2\pi[$[1].

2 The Wheels Equations

2.1 Solving the Wheels Equations

3 Collisions

3.1 Local Collisions

3.2 Non-local Collisions

4 Conclusion

[1] Ideally, we want r smooth and such that $\lim_{\alpha \to 2\pi} r(\alpha) = r(0)$.