Chaotic Bouncy Ball Dynamics

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Abstract

Please include an abstract. It should be a brief paragraph that summarizes the scope and major results of your project.

1 Introduction

This document is a template that you can modify to typeset your project. Have a look at the source file project.tex to see how I set up the sections, equations, figures, and references. For additional information, there are lots of LaTeX resources online. For example, see http://www.howtotex.com/general/five-minute-guide-to-latex.

Latex is a markup language. To create a document, you edit the source file project.tex, which is a simple text file, and then build a pdf file by typing "pdflatex project.tex" at the command line. (There are some free GUI and online versions of Latex too. A popular online version is www.overleaf.com).) Sometimes you have to run "pdflatex project.tex" a few times for the references and links to render properly. You may create your own tex file or edit this file to get started. If you create your own, please use the same style employed here (font size, margins, etc). With this page style, I am expecting about 10 pages of text and equations, not including figures.

Please spell check! There are lots of tools for spell-checking LaTeX files, such as ispell on Unix/Linux/Mac platforms.

Your introduction should review the some background context and theory of your topic. Please remember to cite your sources for all non-obvious material. You can cite the textbook [1] as well as other relevant sources, like papers [2]. References are listed at the end of the document, and linked to in the text with the cite command and labels.

2 Equations

You should review the basic equations for your problem. I like to use the align environment for equations. Equations can be numbered, like

$$m\ddot{x} = -b\dot{x}, \tag{1}$$

which is handy because you can refer back to them later. In equation (1), m is the mass of the particle and $\dot{x}$ is the velocity. Similarly, equations can be unnumbered, as in

$$m\ddot{y} = -mg - b\dot{v},$$

in which case a label is not required; and multi-line, as in

$$\begin{aligned} m\dot{v_x} &= -bv_x, \\ m\dot{v_y} &= -mg - bv_y, \end{aligned}$$

where \\ is the line break and & sets the alignment point.

3 Analysis

I would like to see some analysis of your equations. This could include one or several of the following: dimensional analysis, linearization, special exact solutions, etc. Again, don't forget to cite your sources if you are following an approach that you have seen somewhere else.

4 Computations

Depending on your topic, you might want to show some numerical solutions, e.g. from Maple. If you do this, include a list of the parameter values you are considering (in a table if necessary) and say a few words about why you have chosen these parameters. You should then present and discuss some figures that illustrate the solutions. For clarity, please put your figures at the end of the document. You can use labels to link to them. In figure 1, it is clear that the particle range is significantly limited when drag is introduced.

5 Conclusions

Finally, end with a summary of your problem, approach, and findings. It is also nice to finish with some speculation about how your results might apply to other problems, and/or to mention avenues for future work.

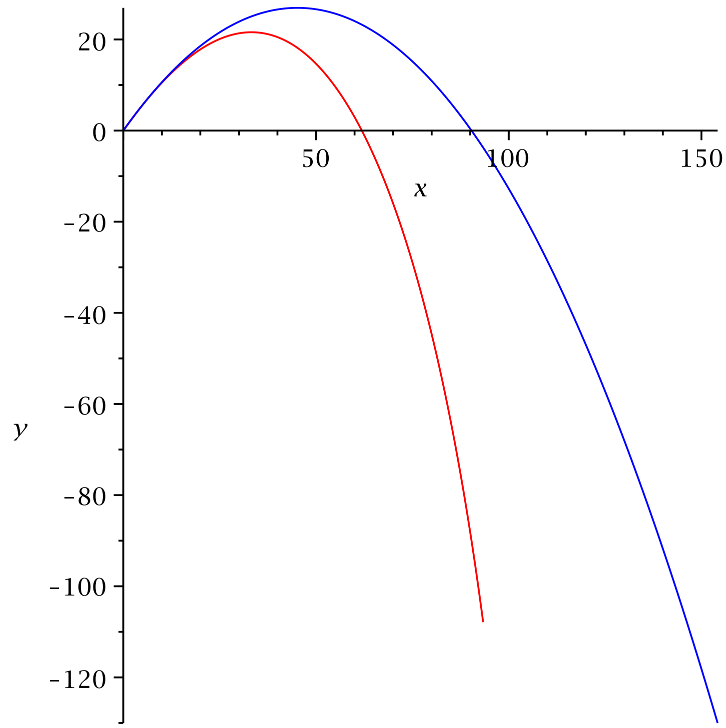

Figure 1: Please include informative captions. This figure compares the trajectories of two particles with $m = 0.15$ kg and initial velocity 30 ms^{-1} oriented 50° from the positive x-axis, for a particle with no drag (blue) and quadratic drag with $c = 0.001$ kgm^{-1} (red).

References

[1] Lautrup, B. *Physics of Continuous Matter*, 2nd ed. CRC Press, 2011.

[2] Lorenz, E. N. Deterministic nonperiodic flow. *J. Atmos. Sci.* **20**, 130-141, 1963.