Contents

Laboratory Calculus I: Lab Project

Bouncing Ball

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Team Members:

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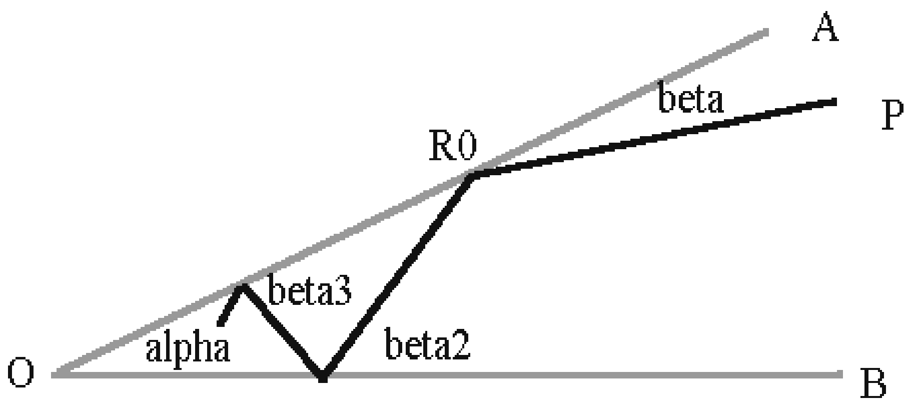

Introduction: The famous magician Michael Moshen has an act in which he stands in a large triangular sculpture and bounces balls off the sides, keeping them in motion. This is a look at the elementary mathematics of what he is doing.

The Context to be Investigated: Two plane surfaces, one parallel to the ground, meet at an angle $\theta = 30$ degrees. A ball is thrown against the upper plane at an angle $\beta = 5$ degrees with a velocity of 20 feet per second. It hits 10 feet from the corner and five feet above the ground. The ball bounces elastically, with no spin or air resistance but is acted upon by gravity.

Develop a mathematical model for the path the ball follows with and without the influence of gravity. First assume that there is no gravity and calculate the path of the ball as it bounces between the planes. Vary the initial velocity, angle of entry, and angle made by the two planes. Can the ball be made to bounce any number of times?

Repeat the investigation with the influence of gravity. Compare the paths of the ball with and without gravity for different initial velocities, angles of entry, angles between the planes, etc.

Finally, repeat the investigation for a ball that is not perfectly elastic. Suppose the ball always rebounds from a surface with the component of its velocity normal to the surface having only 75% of its magnitude prior to impact.