

Abstract Submitted
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Dynamic Modeling and Simulation of a Real World Billiard

ALEXANDRE HARTL, North Carolina State University, BRUCE MILLER, Texas Christian University — Scientists have investigated gravitational billiards since they exhibit a variety of dynamical phenomena in nonlinear Hamiltonian systems. The system typically consists of a particle undergoing elastic collisions within a boundary, where the particle assumes a ballistic trajectory between collisions. This paper considers the more realistic situation of an inelastic, rotating, gravitational billiard in which there are retarding forces due to air resistance and friction. In this case the motion is not conservative, and the billiard is a sphere of finite size. Here we present a dynamical model that captures the relevant dynamics required for describing the motion of a real world billiard for arbitrary boundaries. An application of the model considers parabolic, wedge and hyperbolic billiards that are driven sinusoidally. Direct comparisons are made between the model's results and experimental data previously collected. Although several studies have investigated the effect of variable elasticity in relation to the gravitational billiard, this study is the first to incorporate rotation and additional forms of energy dissipation.

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