

The flat bounce of an elastic ball on a corner : how to make the perfect shot in squash game

Philippe Brunet¹, Akash Garg², Basile Audoly³, Caroline Cohen⁴ & Baptiste Darbois-Textier^{4,5}

¹ Laboratoire Matière et Systèmes Complexes UMR CNRS 7057, Université de Paris, 75205 Paris Cedex 13

² Computer Science Dept. Columbia University New York, New York 10027

³ Laboratoire de Mécanique des Solides, Ecole Polytechnique, 91128 Palaiseau

⁴ LadHyX, UMR 7646 du CNRS, Ecole Polytechnique, 91128 Palaiseau

⁵ Laboratoire FAST - Université Paris-Saclay, 91405 Orsay

philippe.brunet@univ-paris-diderot.fr

A deformable spherical ball colliding very near the corner of two walls experiences unusual bounce : the restitution coefficient is much smaller than that obtained when the sphere collides the two walls far from the corner, and under some conditions the angle of the bounce can be very different from the incident one. This is practically observed during squash rallies, where these slow, unpredictable - and sometimes dead - bounces are produced on purpose by experienced players - these are the so-called 'nick' shots. We carried out high-speed observations of such bounces, from which we extracted the bounce angle and restitution coefficient. These experiments are compared to results from numerical simulations of a simple two-dimensional model, which enables to access a broader range of parameters like incident velocity and friction coefficient. We browse the distance d_c of the impact location from the corner. For all configurations, a nick shot is observed for a range of d_c , which width depends on both impact velocity and friction coefficient.

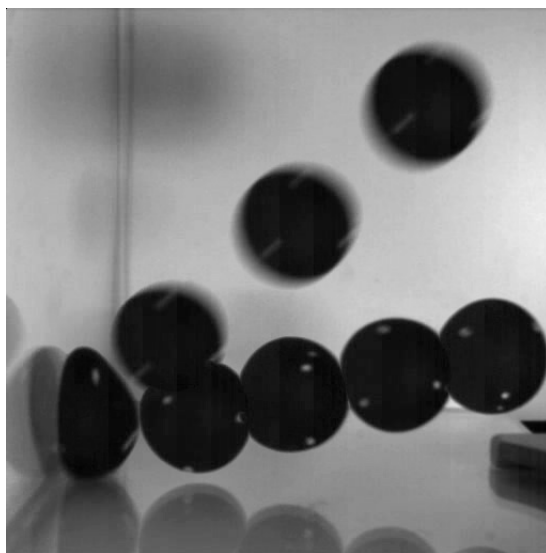


Figure 1. Successive positions of a squash ball colliding near a corner. While the ball incident trajectory is about 45 degrees with respect to horizontal, it bounces back at an angle of less than 10 degrees.

Références