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GRAZING INDUCED BIFURCATIONS IN IMPACTING SYSTEMS

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ABSTRACT

In this lecture I will discuss linear oscillators undergoing impact with secondary elastic supports, which are studied experimentally and semi-analytically for near-grazing conditions. We discovered a narrow band of chaos close to the grazing condition and this phenomenon was observed experimentally for a range of system parameters. Through numerical stability analysis, we argue that this abrupt onset to chaos is caused by a dangerous bifurcation in which two unstable period-3 orbits, created at "invisible" grazings, take part.
The experimentally observed bifurcations are explained with help from simulations based on mapping solutions between locally smooth subspaces. Smooth as well as non-smooth bifurcations are observed, and the resulting atypical bifurcations are explained, often as an interplay between them. In order to understand the observed bifurcation scenarios, a global analysis is required, due to the influence of stable and unstable orbits which are born in distant bifurcations but become important at near-grazing conditions. The good degree of correspondence between experiment and theory fully justifies the modelling approach.

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