
Planar linkages, geodesic flows, billiards and chaos

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Abstract

A mechanical linkage is a mechanism made of rigid rods linked together by flexible joints, in which some vertices are pinned down to the plane while others may move. If the system is given an initial speed, and if no external force applies, then its physical behavior corresponds to the geodesic flow on the configuration space endowed with some Riemannian metric. In 2003, Hunt and MacKay showed that the behavior of Thurston's "triple linkage" is an Anosov flow: it is expected that many linkages have this property, but no other example was known until now.

I will introduce a new example of a 5-rod linkage with Anosov behavior. It is obtained by a new method using the well-known chaoticity of billiards with dispersing walls (Sinai's billiards), and the approximation of the billiard flow by the geodesic flows of "flattened" surfaces. This is the first example of an Anosov linkage in which the lengths of the rods are given explicitly.

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