INSTABILITY ZONE FOR BILLIARDS ON OVALS

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The billiard problem consists in the free motion of a point particle in the plane region enclosed by an oval, being reflected elastically at the impacts with the boundary. Since the particle moves with constant velocity inside the region, the motion is completely determined by the point of reflection and the direction of movement immediately after each reflection. This billiard model defines a conservative two dimensional discrete dynamical system on an annulus. If the oval is sufficiently differentiable then there are invariant non trivial curves near the boundary of the annulus. The region between two consecutive invariant curves was called instability zone by Birkhoff. Together with M.J. Dias Carneiro and S. Oliffson Kamphorst, we investigate the generic dynamics on the instability zone that contains the 2-periodic orbits and show that the the closure of the invariant manifolds of the largest diameter of the oval together with a countable union of disks sorrounding periodic orbits fills this instability zone.