Anosov Behaviour in the Pentagon System

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This project studied the dynamical behaviour of the pentagon n, to determine if it exhibited Anosov behaviour. This is a strict form of chaotic behaviour, any Anosov system is necessarily chaotic. At this stage only one physically realisable system, the Triple Linkage, is known, see Hunt and MacKay [1]. The Anosov definition requires that the Gaussian Curvature of the geodesic flow is negative everywhere. It also requires some additional constraints relating to continuity and differentiability.

My work involved analytically studying the Gaussian curvature both by hand and using two symbolic programs: Mathematica and Matlab. It was found that using certain modified pentagon structures, see Figure 1 below, resulted in a parameter set which satisfied the condition for negative curvature. This was found exactly with Mathematica, and Matlab was used to provide a numerical check.

At this stage the other properties of continuity and differentiability have not been checked. They will likely hold, since the system is physically buildable, its properties should be real physical quantities, thus continuous, well defined and bounded. It is intended to complete these checks, and then publish the results in a small article. This will allow the pentagon system to claim its place as the second physically realisable Anosov System.

I would like to thank Holger Dullin for all the help he provided with learning the theory behind the definition of Anosov behaviour, and also for helping with me learning to use Mathematica, since I had not used it before.

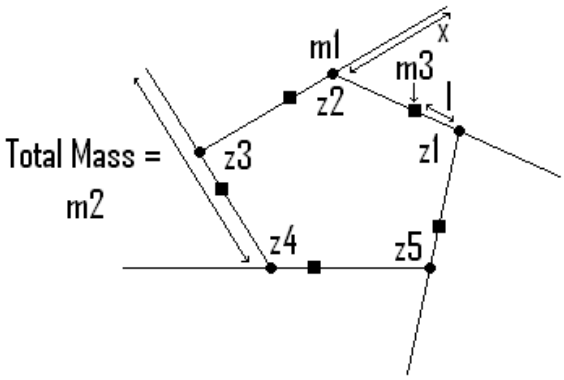

Figure 1: The Modified Pentagon System.

References:

1. T J Hunt and R S MacKay, *Nonlinearity,* **16** (2003) pg 1499–1510
"Anosov parameter values for the triple linkage and a physical system with a uniformly chaotic attractor"

Blake received an AMSI Vacation Scholarship in December 2010 See: www.amsi.org.au/vs10.php