Math Methods (PHYS 320):17

Spring 2017

Reading: Finish reading Chapter 13, at least the first 9 sections.

These are due on Thursday May 4

(1) Using the mathematica notebook I've posted find the symmetric mode we observed in class. What are the necessary initial conditions? Express these as the ratio

$$\frac{\varphi(0)}{\theta(0)}.$$

(2) Using the mathematica notebook I've posted, estimate the initial value of θ at the onset of chaos in the configuration of the physics sculpture in the atrium, i.e.

$$0 \leq \theta(0) \leq \frac{\pi}{2} \text{ and } \phi(0) = \pi.$$

Assume the double pendulum starts from rest. When you submit your solutions print out the final Lyapunov exponent plot and estimate the exponent.

(3) The goal in the 2015 negotiation with Iran was to increase the length of time required to produce a nuclear weapon - the "breakout time". The idea was that, even if there is a political crisis, there wouldn't be enough U235 ready for at least a year. The breakout time before the treaty was estimated to be on the order of 2-3 months. The negotiators wanted to increase this to one year. Based on our calculation of a minimum mass of 200 kg, and a stockpile of 7000 kg of 4 % enriched uranium ore, what must be the enrichment rate that the negotiators estimated before and after the treaty? Express your results in kg of ore per month.