Homework 3: Finding and Mapping Chaos

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Introduction

The system described is a physical pendulum defined by the three parameters: driving force F_D, damping q, and driving frequency Ω_D.

Method

Euler-Cromer is used to calculate θ and ω.

Verification of program

The figures shown here resemble the respective figures in the textbook.

Data

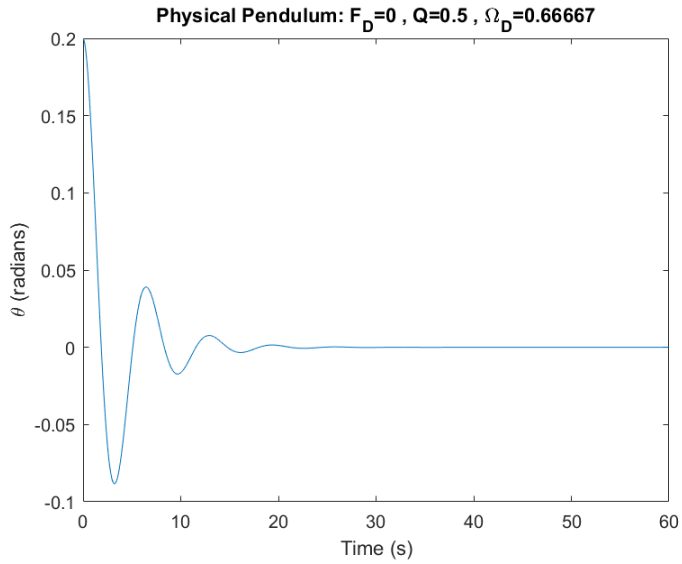

Figure 1: Resembles Figure 3.6 in textbook.

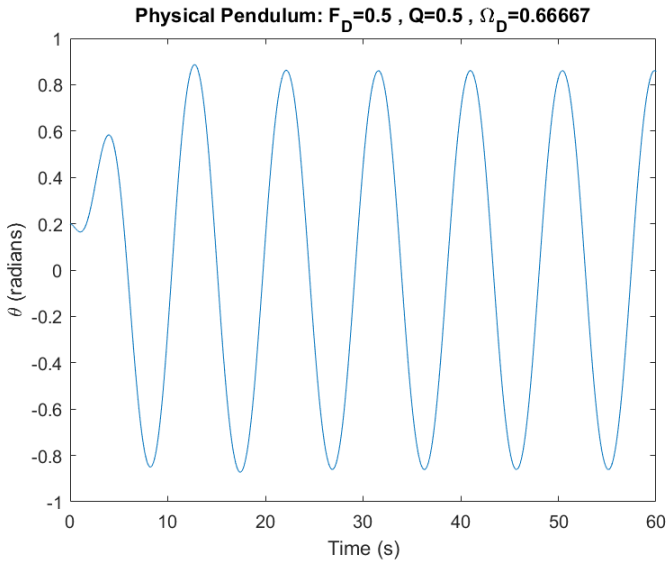

Figure 2: Resembles Figure 3.6 in textbook.

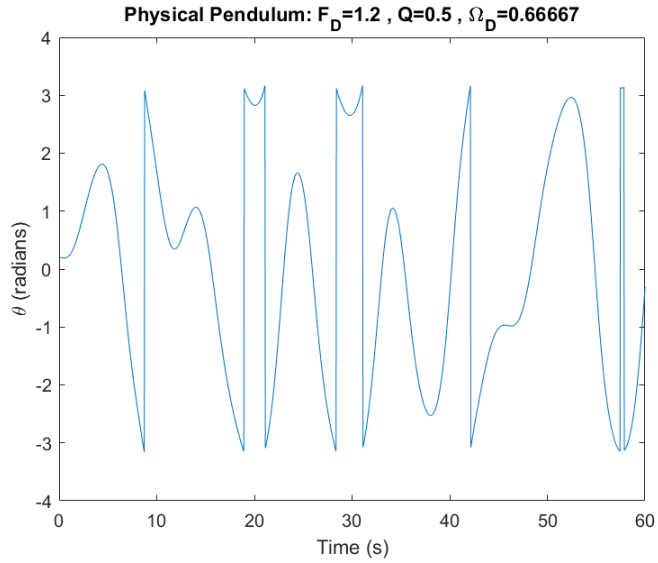

Figure 3: Resembles Figure 3.6 in textbook.

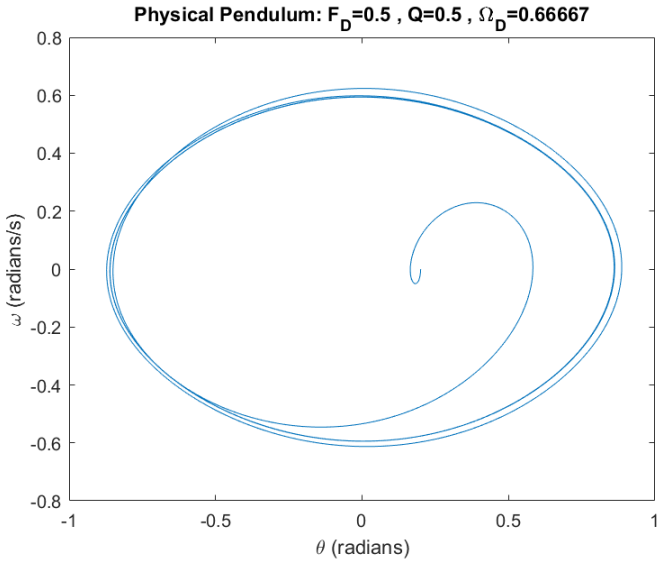

Figure 4: Resembles Figure 3.8 in textbook.

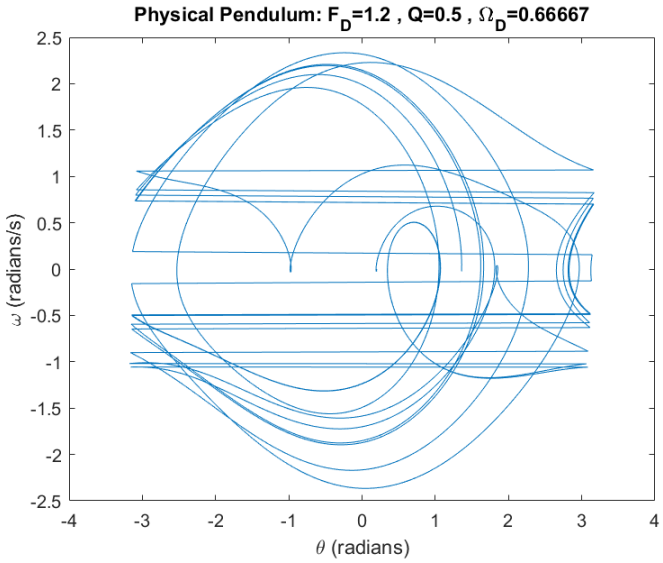

Figure 5: Resembles Figure 3.8 in textbook.

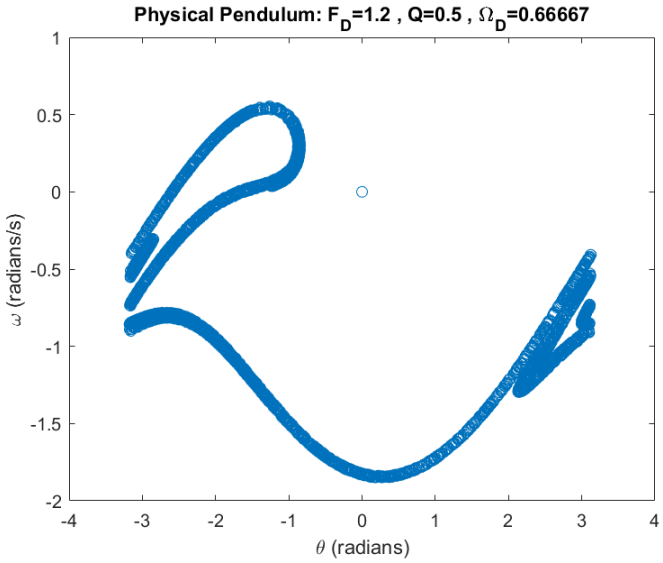

Figure 6: Resembles Figure 3.9 in textbook.

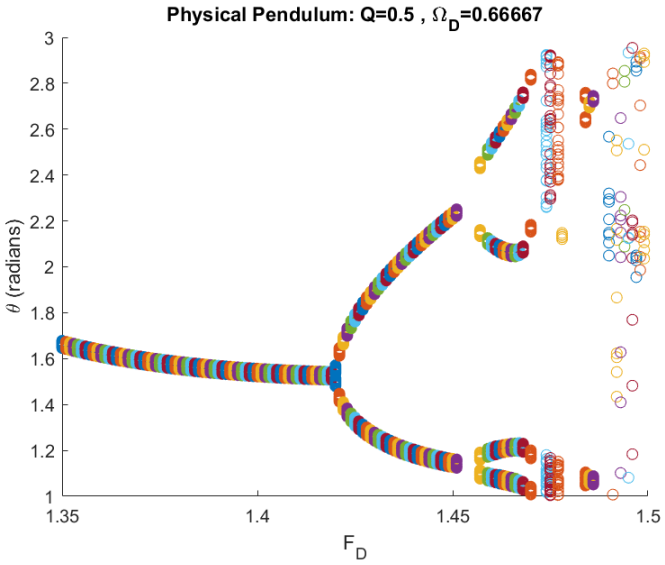

Figure 7: Resembles Figure 3.11 in textbook.

Analysis

Figure 1 ($F_D = 0$) is not driven. **Figure 2** ($F_D = 0.5$) is driven, but stable. **Figure 3** ($F_D = 1.2$) is chaotic. Furthermore, the stability of $F_D = 0.5$ is observed in the phase diagram in **Figure 4** while the chaos of $F_D = 1.2$ is observed in the phase diagram in **Figure 5**.

Critique

Poincaré sections were the major topic covered in this assignment. We really only care about the points in phase with the driving force.