

Numerical Analysis assignment No. 4

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1 Assignment 1

I set:

$$\alpha = 0.5$$

$$\beta = -0.5$$

$$\gamma = 0.02$$

$$F = 0.0008$$

$$\omega = 1.48$$

The result is shown below as Figure 1.

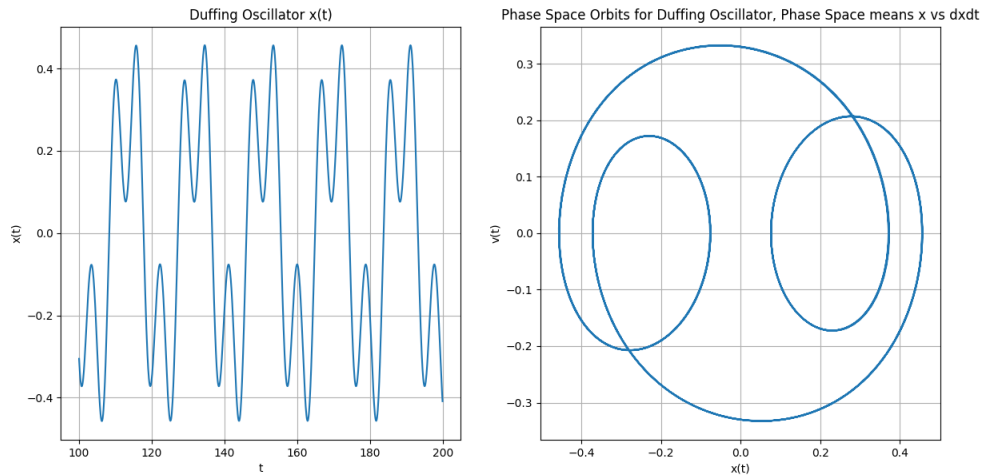


Figure 1 Duffing oscillator of assignment 1.

2 Assignment 2

First, to express Ueda oscillator, I set $\alpha = 0$, $\beta = 1$. Then, I tested a lot of parameters to emulate the assignment figure. Finally, I set:

$$\gamma = 0.03$$

$$F = 3.00$$

$$\omega = 1.48$$

The result is shown below as Figure 2.

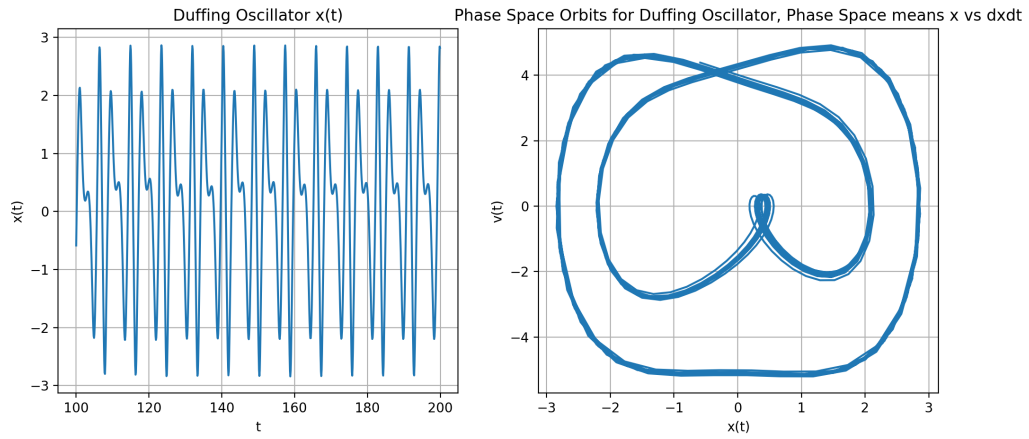


Figure 2 Ueda oscillator (1).

Additionally, in the ref. [1], the parameters are:

$$\gamma = 0.01$$

$$F = 0.9$$

$$\omega = 1$$

The result is shown below as Figure 2.

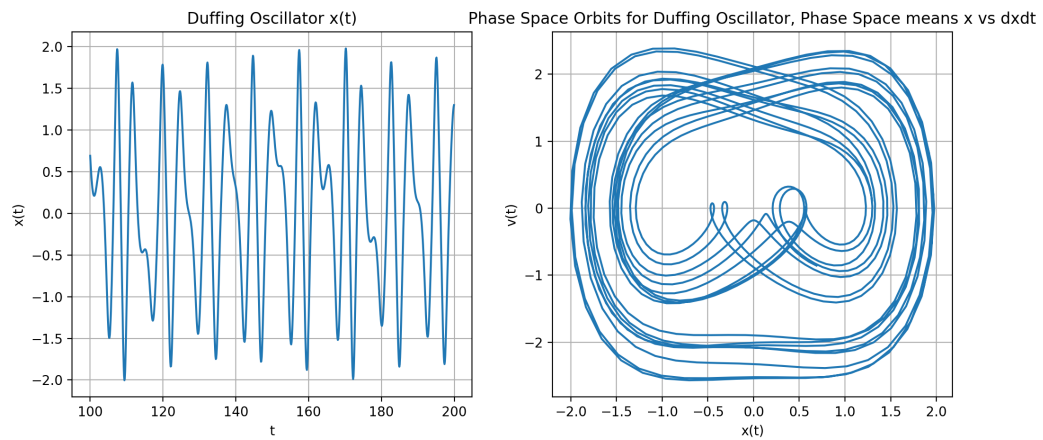


Figure 3 Ueda oscillator (2).

The Ueda oscillator seems to be chaotic oscillator because when I changed one parameter a little bit (like 0.0001), the result phase space changed significantly.

References

- [1] K. Ivana, B. Michael, “*The Duffing Equation: Nonlinear Oscillators and their Behaviour*”, John Wiley Sons, 2011.