PHYS20161 – 1$^{\text{st}}$ Assignment: Forced Oscillations

October 2023

A system undergoes forced oscillations. The frequency of these oscillations is in the range $1\,\text{Hz}$ to $200\,\text{Hz}$ and the amplitude, A, of this oscillating system is given as a function of time (in sec), t, by equation 1:

$$A(t) = \frac{1}{A_0 + a_1 t^2} \cos(a_2 t) \, , \tag{1}$$

where a_1 and a_2 have positive non-zero values only. A_0 is a fixed constant and has the value $A_0 = 2.0\,\text{m}^{-1}$. The parameter a_1 is limited to the range $0.1 < a_1 < 50.0\,\text{m}^{-1}\,\text{s}^{-2}$.

Your code should ask for the frequency of the oscillations and a value for a_1. Additionally, the user should be asked to enter a minimum fractional intensity, $I_{\text{min}}^{\text{f}}$ where the fractional intensity is the intensity (in m^2) divided by the maximum intensity.

The code is then expected to calculate the following:

- The number of oscillations, n_{osc}, where the fractional intensity is larger than $I_{\text{min}}^{\text{f}}$.

- How many seconds, t_{osc}, (to three decimal places) it takes to complete the oscillations.

n_{osc} is an integer and increments by one every time the intensity is zero.

An example is shown below for $I_{\text{min}}^{\text{f}} = 0.2$ which gives $n_{\text{osc}} = 4$ and $t_{\text{osc}} \sim 1.25\,\text{s}$.
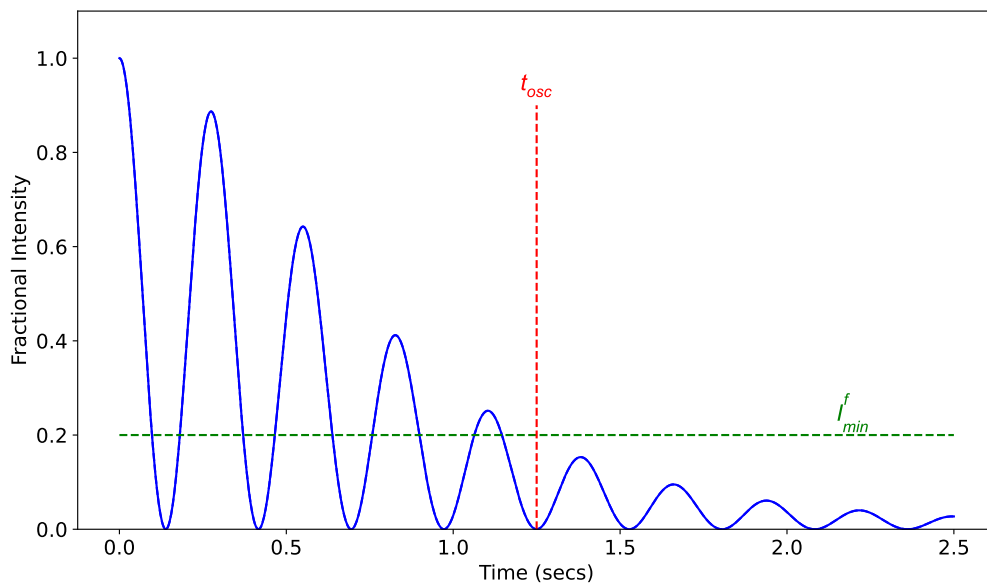
37.5% of the marks are assigned to the calculation.

37.5% of the marks are assigned to programming style and we expect your code to contain:

- A clear header with title, author, date and purpose of the code.

- Useful comments and white space to make it readable.

- Useful functions that break up the calculations.

- Unambiguous variable and function names.

- Results outputted to the screen clearly and to specification.

25% is available for additional features. For instance, can it calculate or do anything else? Can the user decide this? Does it validate inputs and does it validate them well? Does the code get a high positive Linter score?

Further details on how the mark is split can be found in the rubric on BlackBoard.