Assignment 4

➼ **Read the assignment carefully! Remember that the first line of a script must be the call to the script preamble.**

A. Mandatory

Write a MATLAB script Assignment04A_IDxx.m[1] that solves the following exercise.

A harmonic oscillation can be written in the form $y(t) = A \sin(\omega t - \varphi)$. Define a function handle harm that returns $y(t)$ as a function of t, A, ω, φ. Let $y_1(t), y_2(t)$ be two harmonic oscillations with amplitudes A_i, phases φ_i and common circular frequency ω. The sum $y_S(t) = y_1(t) + y_2(t)$ is a harmonic oscillation $y_S(t) = A_S \sin(\omega t - \varphi_S)$, with:

$$A_S = \sqrt{A_1^2 + A_2^2 + 2 A_1 A_2 \cos(\varphi_2 - \varphi_1)}, \tag{1}$$

$$\varphi_S = \arctan \frac{A_1 \sin \varphi_1 + A_2 \sin \varphi_2}{A_1 \cos \varphi_1 + A_2 \cos \varphi_2}. \tag{2}$$

Define two function handles Asum and phisum that return A_S and φ_S as a function of $A_1, A_2, \varphi_1, \varphi_2$. Note that the function atan2 has to be used to compute the arc tangent in Equation (2).

Set $A_1 = 1, A_2 = 2, \varphi_1 = \pi/3, \varphi_2 = -\pi/2, \omega = 1.5$. Compute and display A_S and φ_S, using Asum and phisum. Create a vector t with 1000 elements in the range $0 \leq t \leq 15$ and use harm to compute $y_1(t), y_2(t)$ and $y_S(t)$. Open a figure and create a plot that shows the superimposed graphs of $y_1(t), y_2(t), y_1(t) + y_2(t)$ and $y_S(t)$. Choose the line styles in such a way that one can see that the graphs of $y_1(t) + y_2(t)$ and $y_S(t)$ coincide. Add axis labels, a title and a legend to the plot.
(4 pt)

➼ **If possible, use LATEX strings for axis labels, legend strings, titles etc.. Make sure that the relevant results and *only* those are shown in the output to the command window.**

Continued on page 2!

---

[1]xx is your two-digit ID number number

B. Optional

Write a MATLAB script Assignment04B_IDxx.m[1] that creates two figures, where figure 1 shows a surface plot and figure 2 shows a contour plot of the function in Function04.m. The range of x and y is the interval $[-8, 8]$. The contour plot should have the same scale on the x and y axes and display 20 contour lines, with heights equally spaced between the minimal and the maximal function value in the range of x and y. Add axis labels, a title and color bars to both plots. *(2 pt)*

➡ **If possible, use LaTeX strings for axis labels, legend strings, titles etc.. Make sure that the relevant results and *only* those are shown in the output to the command window.**

➡ **Submit the script(s) until 5pm on April 21, 2021. Any violation of the naming convention will lead to the rejection of the submission!**