SY50 EXAMEN FINAL 1st PART

(Groupe 13)

**EXERCICE 1 (5 POINTS)**

Consider the following functions



Determine for each of them a suitable training set, validation set and test set. Pay attention that the behavior of the function at the origin and consider that ±1 is not a discontinuity. Build it by adding a small random noise. Then build a MLP neural network with a suitable number of hidden neurons to approximate it. Make different trials before choosing the best one and justify the results with a comparative table (it is up to you to choose the columns of the performance indexes to consider)

**EXERCICE 2 (5 POINTS)**

It is desired that the following forward system be controlled with a unitary negative feedback so that il will have a damping ratio of 0.5 for dominant complex roots and *Ts≤ 2 s*. *Kx>20s -2*

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1. What is the type of the system ? What does it mean?
2. Why is there a requirement on *Kx?*
3. By using the Root Locus (RL), draw the uncompensated system and determine, if possible, the value of *Kx*for the desired poles. Justify quickly the RL obtained with Matlab with the rules learnt during the lectures
4. Compensate the system with a cascade compensator selected among those explained in the course (PI, PD, PID, Lag, etc..) so as to satisfy the requirements.
5. Verify, by using the closed-loop Bode diagram if the bandwidth (ωm) of the system increases or not and explain why. Verify also that the Bode Diagram of the Open –Loop control system has a good phase margin (what does that mean?)

*Remark 1: The compensator should be physically realizable, which means that the number of its poles must be greater or the same as the number of zeros.*

*Remark 2: It may happen that the system cannot be controlled whatever compensator you use. In that case try to justify that*.