

## Problem n.4

The file `reflectance.txt` contains the reflectance spectroscopy of 101 fossils. The reflectance is measured in the range of wavelength  $[401, 2500]$ . Consider a functional data analysis approach where, for each fossil, the measurements provided are considered as discrete sampling of underlying smooth functions.

- a) Perform a smoothing of each datum through regression splines of order 4, with 11 basis function. Provide a plot of the smoothed data and report the first 3 coefficients obtained for the first datum.
- b) Perform a functional principal component analysis of the smoothed data obtained at point (a). Report the variance explained along the first 4 functional principal components. and the screeplot.
- c) Propose a possible dimensionality reduction for the data and justify your choice. Plot the retained principal components.
- d) Plot the retained principal components as perturbation of the mean, and interpret them.
- e) Provide a plot of the scores along the first two principal components and comment the results.

Upload your results here:

<https://forms.office.com/Pages/ResponsePage.aspx?id=K3EXCvNtXUKAjjCd8ope6-9AS0Gwf2lHjvGX24HiqFVUNzBMTEhEMkZNSUo5WUVFREIwTk1ZVEhYMS4u>