04OAGQD - Vibration mechanics (prof. Fasana) 2021-2022

DeXpiLab1, 17th March 2022

The Virtual DeXpiLab1 experience requires the students to run simulations of a clamped free beam using the software in VirtualDexpiLab 1.mlappinstall (to be installed and run in Matlab) from which both simulated data and experimental measurements can be saved (exported) to be later analyzed.

The students will be possibly required to write a short report (a pdf of MAX 3 pages) and to upload it in the section "elaborati" in the Portale della Didattica (further instructions will be given later).

This report should contain at least:

0. Selected parameters by the students. N.B., Each student should use for points 1 to 4 a beam length of: $L = 30 + 3 \cdot U$ where U is the last digit of the students' PoliTo id number (e.g., *s12345U*). The material of the beam, the added mass, the initial displacement for the free response, the length of the simulation and the sampling frequency can be freely changed.

1. Estimate the Natural frequency and modal damping ratio of the **first mode** using the **logarithmic decrement method** (a $ln|x|$ graph could be useful), both for *experimental* measurements and *simulations*.

2. A spectral analysis (**FFT**) of the free response, showing the **first natural frequencies** (a graph could be useful) (*simulations* only).

3. With null added mass (**M=0**), a comparison of the results at point 2 with those of the **Euler-Bernoulli** beam theory (*simulations* only).

4. With an added mass (**M≠0**), a comparison of the results at point 2 with the approximate values of one of the **formulas accessible on the web** (sample keywords: cantilever beam, added mass at the free end, concentrated mass, lumped mass, free vibration, natural frequency) (*simulations* only).

5. A brief discussion about the **influence** of **material**, **length** of the beam and added **mass** (*simulations* only).