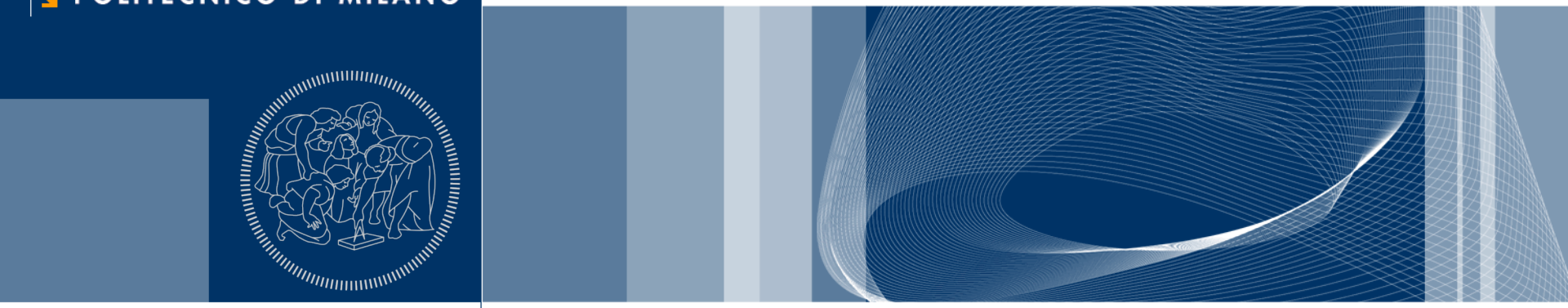
POLITECNICO DI MILANO



Modeling Techniques homework

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Instructions

- Homeworks can be done in groups up to 3 people
- You must upload on the beep folder the exercise files and a report describing your choices.
- The deadline for uploading your solutions is 23:59 - 16/01/2021

FD implementation of piano string

- Implement the piano string FD model considering the hammer interaction
- The problem is analyzed on the slides:
  - `06_modeling_of_musical_instrument`
  - `Pages 23-35`
- A detailed description is provided in the references (`page 36`)
- Complete the code template `homework_piano.m`

FD implementation of piano string

- Suggested parameters:
  - $f_1 = 65.4$[Hz] C2 fundamental frequency
  - $b_1 = 0.5$
  - $b_2 = 6.25 \times 10^{-9}$
  - $w = 0.2$ width of the hammer spatial window g
  - $Vh_0 = 2.5$[m/s] initial hammer velocity
  - $\kappa = \epsilon$ is the string stiffness coefficient

  - Other parameters can be found on the slides and articles or derived from the given ones.

- Hint:
  - Refer to Chaigne et. Al. for
    - The condition on maximum spatial step X
    - Hammer-string contact duration

FD implementation of piano string

- Complete the code template `homework_piano.m`
  - Compute the simulation of a C2 piano string
  - The signal length is 8s
  - Approximate the sound by averaging the string displacement over a small portion of the string (12 spatial samples).
    - The center of the average portion will be specular with respect to the hammer striking position.
  - After the FD computation:
    - Plot the whole string diplacement at each time instant
    - Plot the estimated sound signal
    - Play the sound
    - Save the estimated sound signal in a file named:
      - `yourIDnumber_surname_piano.wav`

Homework instruction

- All the files must be included in a .zip file named:
  - `yourIDnumber_surname_homework_piano.wav`

- The file must include:
  - A brief report which expains how the FD scheme is implemented and your implementation choices.
  - The source code.
  - The audio file.

- BONUS:
  - Include the solution of the exercise 6 from the modeling of musical instrument exercise session.