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Far-field acoustic prediction using the boundary element method and robotized measurements

Near-field acoustic holography (NAH) and far-field acoustic prediction (FAP) are two numerical techniques widely used to identify and reconstruct the acoustic fields radiated by unknown structures. In particular, the second method proves to be quite usefull when data is only available close to the source, but information in the whole space is required.

However, the practical implementation of such methods is still hindred by two major drawbacks : the lack of efficient implementation of the existing numerical methodologies, and the time-consuming and tedious roll-out of acoustic measurements.

Our work aims to provide a solution to both issues. First, the measurements step is fully automated by using a robotic arm able to accurately gather geometric and acoutic data without any human assistance. Then, the collected data is efficiently processed thanks to FreeFEM BEM (Boundary Element Method) library.

In this presentation, a global overview of the robotic experimental setup will be provided, with a particular attention paid to the impact of the robot on the acoustic pressure measurements. The details of the BEM theory, and its practical use in the FreeFEM implementation of FAP will then be presented. Numerical results, based on simulated measurements, will allow us to assess the overall performance regarding robustness, speed and accuracy. Finally, the results obtained with actual robotized measurements will be presented, along with future work perspective