

Study of spherical microphone array networks for the large spatial scale capture and analysis of acoustic fields

PhD offer from LabeX CelyA - Laboratories : LMFA and LVA

The capture of acoustic fields using microphone arrays is the entry point to any acoustic analysis method such as beamforming [1], acoustic imagery [4], source identification etc... When designing an array, many factors condition the quality of the analysis, among which: the number of microphones, their arrangement [2], array position and orientation, the influence of the array on the acoustic field. Although the increase in number and density of microphones increases the precision and resolution of the analysis, implementing such a strategy can be difficult and expensive [13]. Approaches using parsimonious analysis become relevant in this context [3].

When the geometry of the array makes it possible, the modal approach is an effective strategy for the analysis of acoustic fields [8]: the field is captured by the microphone array and is decomposed on a modal basis and the analysis is performed on said basis. One of the most trending basis is that of spherical harmonics, with the ambisonic technique [5]. The capture of the acoustic field uses a spherical array of microphones [6] which enables the continuous representation around the array. The valid representation area is limited by the first acoustic source (interior problem), increases with the decomposition degree, and decreases for increasing frequencies [12]. In order to enlarge the representation area, recent approaches use networks of spherical microphone arrays [7, 11]. Current applications aim at navigating in acoustic fields for virtual reality [9, 10], but industrial applications are easily imaginable.

In this context, this PhD offer proposes the study of spherical microphone array networks for the large spatial scale capture and analysis of acoustic fields. By relying on the state of the art, the first goal is to assimilate current methods among linear, parametric and non-linear [9]. The LVA has an expertise in bayesian approaches which can be studied in this context [9]. Secondly, an experimental validation of proposed approaches will be performed using a spherical microphone array network.

If the resulting analysis is satisfying, it will be considered to study the reconstruction of the captured acoustic field on a loudspeaker array, by using the experimental facilities of the LMFA.

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