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Large array optimization using a genetic algorithm and application to wide band moving sources imaging

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In order to design a microphone array able to follow moving wide band acoustic sources, and improve the quality of the images obtained with a classical beam forming technique, numerical simulations were carried out. The various steps of the study are presented here.
Searching the best design for a large microphone array, a simple genetic algorithm was developed. Considering a constant outer dimension of the array and technological constraints in order to design an adaptive array of 60 microphones, the algorithm selects among a large set several combinations of their positions. The functional being optimized is the directivity pattern, in terms of side lobes level. The genetic algorithm always converges to solutions comparable to a randomized set of microphones. Besides, taking advantage of symmetry properties of the array, an improvement of the speed of beamforming calculation was introduced.
The optimum array being chosen, wide band moving sources were simulated and images were processed. In order to provide beam formed images with a constant resolution over the band a homotetic-balanced array of 120 microphones was assembled. Finally the dynamic of the images was significantly improved by performing a non-coherent image synthesis technique.