

(Research Article)

## Implementation of the direction of arrival estimation algorithms by means of GPU-parallel processing in the Kuda environment

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### Abstract

Direction-of-arrival (DOA) estimation of audio signals is critical in different areas, including electronic war, sonar, etc. The beamforming methods like Minimum Variance Distortionless Response (MVDR), Delay-and-Sum (DAS), and subspace-based Multiple Signal Classification (MUSIC) are the most known DOA estimation techniques. The mentioned methods have high computational complexity. Hence using the algorithms with high computational complexity in the real-time DOA estimation applications is a serious challenge. On the other hand, the main characteristic of the methods is their high potential for parallelization. The objective of this paper is a parallel implementation of the considered algorithms using a Graphics Processing Unit (GPU) instead of a Central Processing Unit (CPU) for increasing execution speed and real-time implementation of the mentioned algorithms. To this aim, the Kuda programming model is used to implement the algorithm on a GPU. This algorithm is also implemented serially in MATLAB to investigate the parallel implementation performance. The results show that parallel implementation of these algorithms can increase the program execution time ten times more than serial implementation. Accuracies of different implementations are validated using simulations by MATLAB and Kuda.

**Keywords:** Signal Orientation, Beamforming, Parallel Processing, Graphics Processing Unit (GPU), Kuda Programming Model.

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