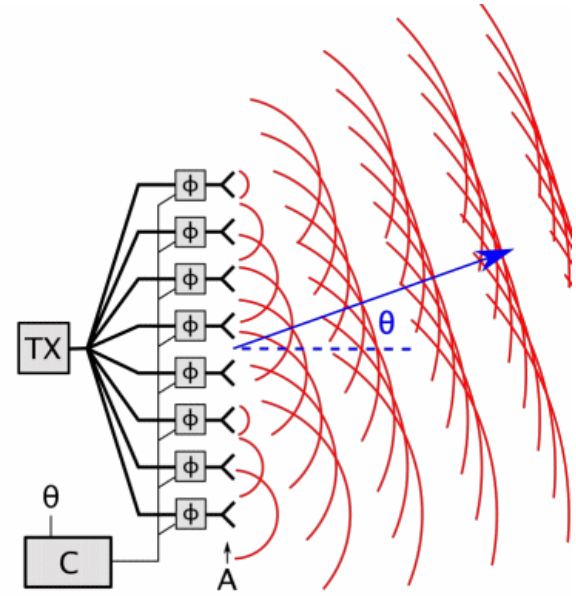
MSc-thesis project in high performance computation for beamforming.

Background



Beamforming, or spatial filtering, is a technique used to transmit signals in a specified direction. The technique can also be used to filter an incoming signal in a direction of interest. In order to achieve this, an array of either sensors or transmitters are placed out spatially, from which either the incoming or outgoing signal is filtered to create directionality.

It is widely used in telecom industry and in military applications for target tracking.

In order to efficiently develop and do research in mentioned applications, a fast computational framework that allows for testing of a variety of beamforming methods is needed to streamline the development

Project Description

The aim of this project is to create a framework consisting of potentially several different beamformers to filter received signals. The project will deal extensively with acoustic signals of underwater vehicles, and are thus likely to have a poor signal to noise ratio. Moreover, the carrier frequency is unknown or non-existent, which will put an extra requirement on the implemented beamformers to work with broadband signals. If done correctly, the framework may significantly make research problems involving beamforming easier, and may become the benchmark used in comparisons.

Beamforming consists of many independent computations, and is thus suitable a candidate for parallel computing. Going into the project, you will first familiarize yourself with implementation of a beamformer for uniform linear arrays, extending the implementation to arbitrary array

geometries, and finally implement a solution that is both fast and efficient. Ideally, several different beamforming techniques are investigated and compared, to see how each can be adapted into the computational framework. A collection of experimental data from real-world recordings of underwater vehicles will also be a part of the project for evaluation.

Needed skills

The potential candidate needs to have good knowledge in

- Digital Signal Processing
- C++ programming language, or similar high performance language.

Complementary skills

Additionally, interest or prior knowledge in following would be beneficial:

- CUDA

Contact

If you find the described project interesting or have any questions, please contact Daniel Bossér at daniel.bosser@liu.se or 073 917 48 46.