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A Parallel Genetic Algorithms applied to acoustic noise cancellation.

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Abstract - Regular Paper

The problem to actively control acoustic noise is addressed in this work specifically those related with implementation and real time parallel processing of a genetic algorithm with TMS320C44 parallel DSP.

The algorithm which uses real time parallel implementations profitly is the genetic algorithm. It creates a population randomly distributed and evaluates the fitness of each individual.

The best individuals are selected, and crossover and mutation take place.

Following few generations, the population converges to the mix of components that better reduce the noise.

An Unix simulator was developed to test the software and an experimental setup was made to check the efficacy and efficiency against the noise (Fig.1).

Two different approaches based on the genetic algorithms (GA) were studied.

In the Simple Genetic Algorithm (SGA) each individual of a generation represents a specific frequency, phase and amplitude used in cancellation of noise, and the fitness function is the average energy of the signal.

The successive approach genetic algorithm (SAGA) is a modification of SGA, where a first level search the best frequencies and a second level improves those values between chosen limits (Fig.2).

A frequency domain version was implemented for operational purposes.

A comparison between the analysed approaches is intensively performed.

The experimental setup consists of a rectangular duct of 18' long, and 3 cylindrical ducts (2", 4", 6" diam.) and an air conditioning system. An application for a real land and airborne vehicle is under study.

Successive Approach GA Noise cancellation

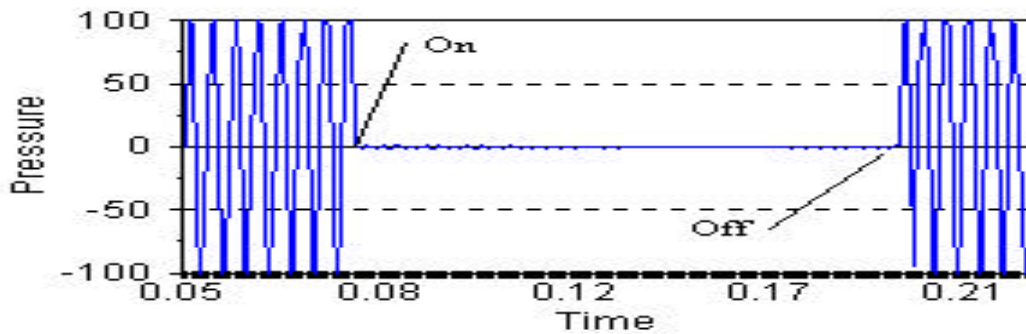


Fig. 1 Unix simulation results of the SAGA algorithm.

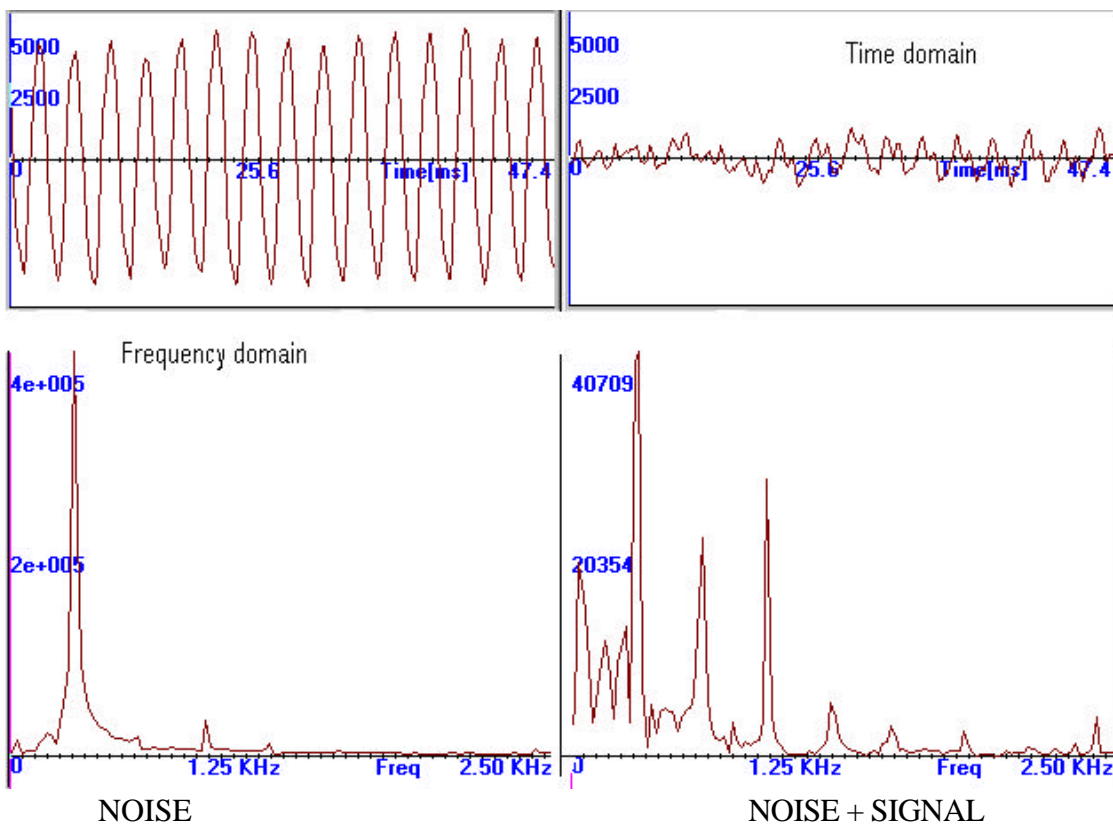


Fig. 2: Experimental result of noise cancellation into the 18' rectangular duct.

Keywords: DSP, Parallel Processing, Active control, Genetic algorithms, noise cancellation.

