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Development of a Simulation Environment for the Design of a Sonar Signal Processing Chain.

ABSTRACT - Masterthesis

In this thesis a simulation environment is developed to support the design process of a sidescan sonar currently engineered by ATLAS ELEKTRONIK. The simulation environment consists of a signal generation realized in MATLAB and a Simulink system model. Using the simulation environment the system design is verified and important system parameters could be defined.

The focus of this thesis is the generation of realistic test signals obtained from a predefined cross track underwater scenario. Here all scattering surfaces like the water surface, seafloor and a possible target are modelled by circular facets being smaller than the utilized wavelength. Roughness is added to the simulated surfaces to be able to adapt the model e.g. to different ground types. Additionally signals due to volume reverberation and ambient noise are calculated. In the ambient noise calculation the spectral distribution of each channel as well as the correlation between the input channels is included.

The Simulink system model was already given and is enhanced to process the generated signals and to obtain realistic amplitude levels. A major issue is the vertical time-delay beamformer which is designed and added to the system model. Therefore an algorithm for the calculation of the time-delays of each channel is derived. Additionally the effect of rounding operations on the time-delays is investigated to simplify the beamformer design.

In the experimental part the received sound pressure levels are compared to the reference SEARAY model. The seafloor signal level matches closely to the reference model while the water surface signal showed a deviation. Also the correct functionality of the vertical beamformer is verified. The chosen design shows the desired surface signal attenuation without a visible degradation of the seafloor signal. Additionally system design parameters are investigated and defined using MATLAB and Simulink based simulations.