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Accurate Simulation of EMAT Probes for Ultrasonic NDT Based on Experimental Measurements

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During the last years, CEA LIST has been developing EMAT probes dedicated to liquid sodium ultrasound applications, including telemetry, defect detection in sodium immersed welds, defect sizing, and more recently using phased array probes, beam forming images and synthetic focusing. At the same time, simulation tools based on the numerical methods available at CEA LIST have been integrated within the CIVA software platform.

This paper focuses on the experimental calibration of the simulation models for liquid sodium EMAT transducers. In particular, it tries to answer the questions regarding choices of input data for the developed models with the goal of carrying out realistic simulations. The full system measurement model, including coil impedances, gains and analog filters need to be taken into account to obtain predictive simulations. Physical measurements allow the precise determination of the needed parameters and allow verifying the different aspects of the EMAT probe behavior. The developed model is then used to propose a design that is optimized with respect to the generation of longitudinal waves in liquid sodium.

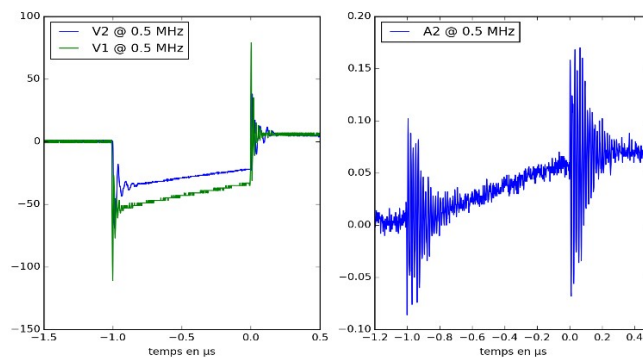
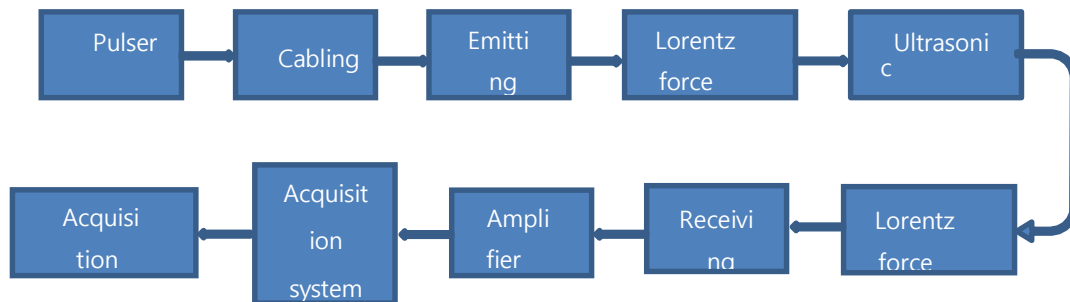


Figure 1. Acquisition system depicted as transfer functions (top) and example of measurements performed on coils (bottom left: voltage, bottom right: current).