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Subject Area	Sensor, Actuator and Communication Systems

Fluid Antenna

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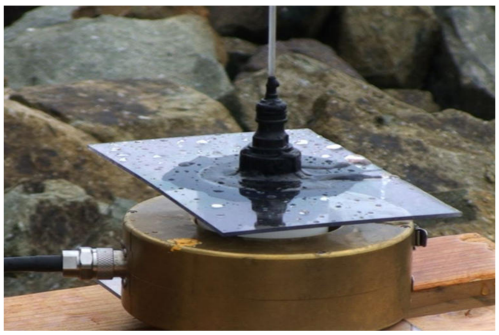
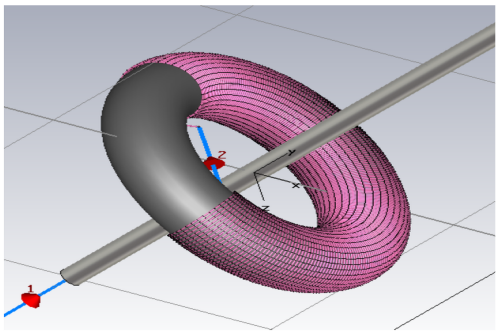
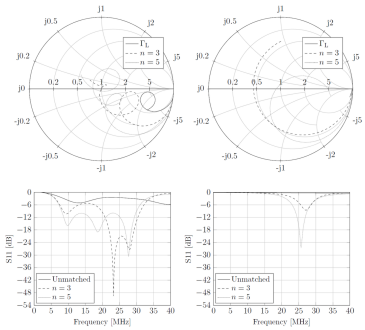


Illustration of the seawater antenna based on design 1, employing a pump and a current-probe.



CST simulation model of the current-transformer structure, as it appears in the seawater antenna based on design 1.



Reflection coefficient of the seawater antennas after impedance matching. Left column: Design 2. Right column: Design 1.

Introduction: Reconfigurable antennas have a huge potential in today's world. They represent an ideal compromise between functionality and occupation of space. In this study, two seawater antennas based on recent design proposals are considered. The first design thereby describes a pump and a current probe, whereby the pump is arranged in such a way that a water jet goes through the aperture of the probe. Together with the sea surface, this configuration represents a monopole antenna. The same applies for the second design, which describes a large plastic tube filled with water, attached to a metallic ground plane. Both antennas are reconfigurable in terms of their operation frequency by simply varying the height of the water column.

Approach/Technologies: To analyze the designs, corresponding antenna structures were defined and modeled using the simulation software CST MWS. Regarding the impedance matching of the antennas, a broadband matching circuit was designed and optimized. A variety of simulations then revealed the theoretical performance of the antennas. It was shown that a thin water jet results in an antenna rather suited for narrow-band applications, while a thick water jet is more appropriate for broadband applications. This thesis also contains general guidelines for the design of current probes and their modeling in CST, whereby the most critical aspects were pointed out. Through a detailed derivation of an equivalent circuit, it was demonstrated that current probes exhibit a bandpass characteristic.

Result: On the basis of the theoretical achievements obtained by the simulations, a prototype of the seawater antenna was built, according to the design that employs a pump and a current probe. In a final experiment, using actual seawater, the proof of concept was successfully established.