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Classification of moisture damage in layered building floors with GPR and neutron probe

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In 2019, 3.1 billion Euro of damage was caused by piped water, accounting for the largest share (53%) of building insurance claims in Germany. In the event of damage, the accurate determination and localization of water ingress is essential to plan for and perform efficient renovations. Neutron probes are already applied successfully on building floors to localize the source of damage and other affected areas. However, additional information about the depth of moisture penetration can only be obtained by the destructive extraction of drilling cores, which is a time- and cost-intensive procedure. With its high sensitivity to water and fast measurement procedure, Ground Penetrating Radar (GPR) can serve as a suitable extension to the neutron probe, enabling more precise characterization of common forms of moisture damage.

In this research project, we study the influence of common types of moisture damage in differing floor constructions using GPR and a neutron probe. A measurement setup with interchangeable layers is used to vary the screed material (cement or anhydrite) and insulation material (Styrofoam, Styrodur, glass wool, perlite), as well as the respective layer thickness. Every configuration is measured for the following main cases: 1) dry state; 2) with a damaged insulation layer and 3) a damaged screed layer.

The evaluation is focused on the extraction of distinctive signal features for GPR, which can be used to classify the underlying case of damage. Furthermore, possible combinations of these features are investigated using multivariate data analysis and machine learning in order to evaluate the influence of different floor constructions.

To validate the developed methods, practical measurements on real damage cases in Germany are carried out and compared to reference data obtained from drilling cores.