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Acoustic properties of partly saturated porous soils

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Controlled experiments are performed on soil samples saturated with different types of liquid such as water and oil to determine the relations between the degree of saturation, type of saturated liquid and the acoustic surface admittance. These experiments are conducted using a Buchner funnel attached directly to an acoustic impedance tube. The results show a very sensitive dependence of the acoustic admittance upon the degree of saturation irrespective of the liquid present. It is found that the relationship between the volumetric water content and the real part of the surface admittance in the frequency range of 500 - 1000 Hz can be expressed using a logarithmic equation. The coefficients of the proposed equation can be determined using a soil property called "uniformity coefficient" and the acoustic admittance of dry soil. Results of volumetric water content obtained using the proposed equation are validated using those obtained from an independent test. The results of the validation exercise demonstrate that the proposed relations can be used to determine very accurately the volumetric water content within soil from the acoustical data. The accuracy of the acoustically measured degree saturation is found to be within 2.0%.