4.2.22. MICROMECHANICAL ASSESSMENT OF ULTRASOUND VELOCITY IN ENTRAINED AIR CEMENT PASTE

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The correlation between porosity and ultrasonic wave velocities of entrained air cement paste material is investigated. In order to vary the cement paste macroscopic porosity, an entrained air admixture was used within the studied samples. The water content was maintained constant by fixing the water/cement ratio to 0.4 in all samples. Two saturation states were studied, namely, dry and fully saturated with water. Based on the micromechanical modeling of two-phase composite with spherical embedded voids, the mechanical (bulk and shear moduli) and ultrasonic (longitudinal and transverse velocities) properties of the entrained air cement paste material were determined. Both longitudinal and transverse velocities were measured accurately using a setup especially designed for the study. Theoretical and experimental correlations with porosity were compared. Two major conclusions were obtained. First, the experimental and micromechanical obtained results showed that the correlation between acoustic and hydraulic parameters agree the expected trends. Longitudinal and transverse velocities decrease with macroporosity. Secondly, the dilute inclusion and the Mori-Tanaka models gave good estimation of the acoustic parameter of the air entrained cement paste, for low macroporosity under 10 %. While, the self-consistent model succeeded in describing the air entrained acoustic parameters in dry and saturated states for all considered macroporosity.