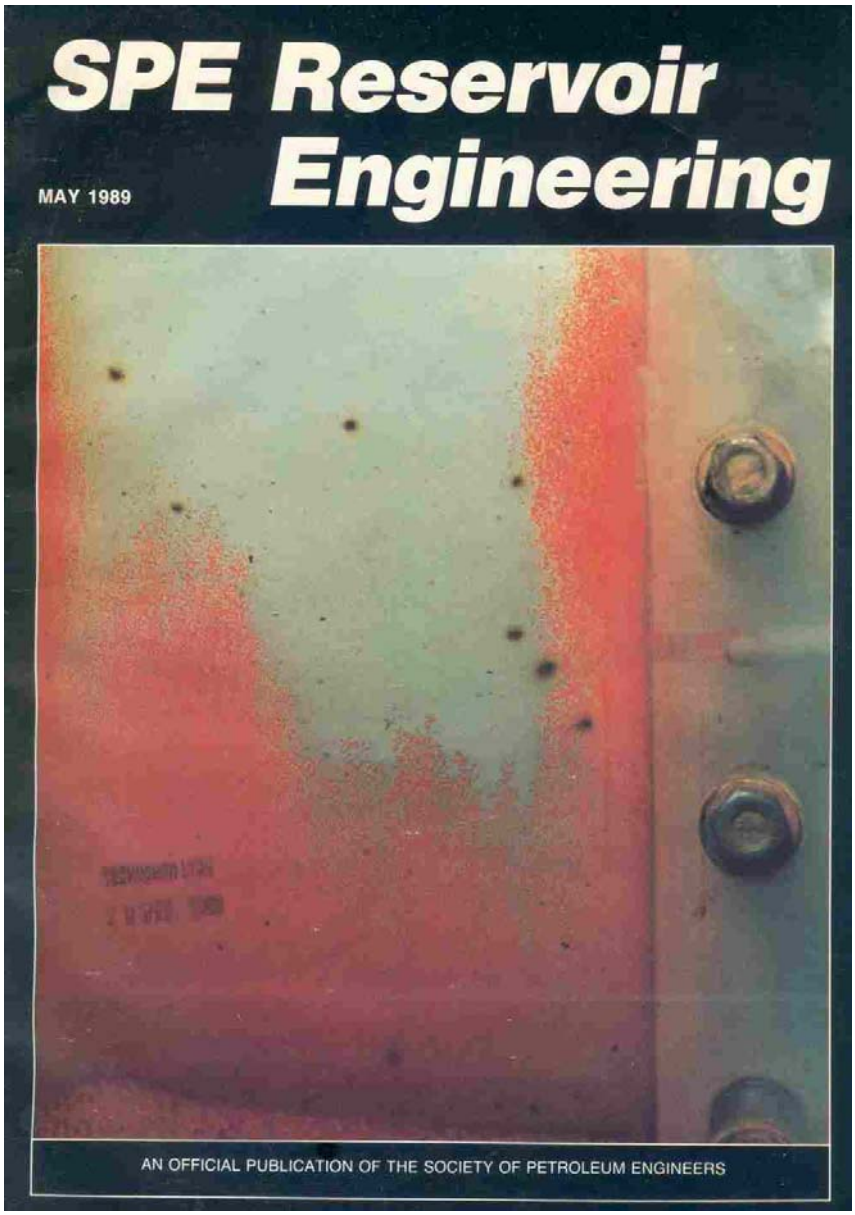


# Ultrasonic Saturation Mapping in Porous Media

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**Summary.** The theory of acoustic propagation in porous media was described by Biot in 1956, but the experimental acoustic technique for measuring two-phase profile saturations along a sample is much more recent. We present an extension of this method for two-dimensional (2D) mapping and comparisons with gamma ray attenuations and visualizations in a transparent cell. The method is based on the difference between the sound velocities in the various liquids saturating the porous medium. The signal is generated by a pulse generator, and the time delay between transmission and reception is measured with a timer/counter. The saturation mappings are obtained by an automated displacement of an array of 32 sensors along the sample followed by computer reconstruction. To check the capabilities of the setup, we performed miscible and immiscible displacements in a three-dimensional planar cell (nonnegligible influence of height). The fluid boundaries are followed simultaneously by visualization and by ultrasonic measurements. We show that this technique not only locates the flood front in the stable case but also reconstructs the exact structure and motion of viscous fingers associated with unfavorable-viscosity-ratio displacements. Unlike X-ray shadowgraphs, quantitative fluid saturation data can also be obtained.