Abstracts

A sub-millimeter accurate microwave multilevel gauging system for liquids in tanks

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A microwave multilevel gauging system employing a frequency-stepped continuous-wave radar measurement technique is described in this paper. A conventional frequency-modulated continuous-wave radar technique is normally employed only to find the level of the liquid surface in storage tanks. The system described here also detects a second level, e.g., the tank floor or an impurity level. If this second reflection dominates, distance measurement with the inverse Fourier transform (IFT) results in poor resolution and shows a very high range error for small gaps between these two scatterers. For estimating the exact time delay and amplitude of the reflection from each scatterer, an optimal signal-processing algorithm is derived, based on a reference model. Performance of the multiple target-detection reference model is illustrated using measured data obtained with an HP-8510 network analyzer. It is demonstrated that the reference model offers a significant enhancement of resolution over the standard processing IFT algorithm and is insensitive to noise and clutter signals. The described system achieves a time-delay accuracy with a bandwidth of /spl Delta/f=1 GHz, which corresponds to a range error of /spl plusmn/0.2 mm.

❑ Return to main document.