

Small bore tube Inspection using Magnetostrictive Guided Ultrasound Technique

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A long-range guided ultrasound technique using a magnetostrictive sensor has been developed to inspect a small bore tube. The phase velocity dispersion curves and group velocity dispersion curves were calculated, shown in Fig. 1.

A Ni patch with magnetized along the circumferential direction were glued to the small bore tube. The AC current was applied to a ribbon coil surrounded to the Ni patch. From the DC magnetization by a Ni patch along the circumferential direction and AC magnetization along the axial direction generates a torsional guided wave, following the Widemann effect. A torsional guided ultrasound, T(0,1) mode with frequency of 64 kHz was generated in the small bore tube and the signals reflected from the 6 m long stainless steel tubes were successfully acquired.

A typical example of acquired signal is shown in Fig. 2. The signal from the location of 3 m is identified as T(0,1) mode. A successive peak followed major peak at the location of 3 m was identified as F(1,1) mode, after review of acoustic velocity and dispersion curves in Fig. 1. The ratio of width to the length of the Ni patch should be at least 1 to 8 to get a good torsional mode generation. However, a relatively short length Ni patch must be applied to the small bore tube, result in a additional mode, such as F(1,1) mode.

The long-range guided ultrasound technique using a magnetostrictive sensor can be used to the field inspection of small bore tubes in the nuclear power plants with simple and easy.

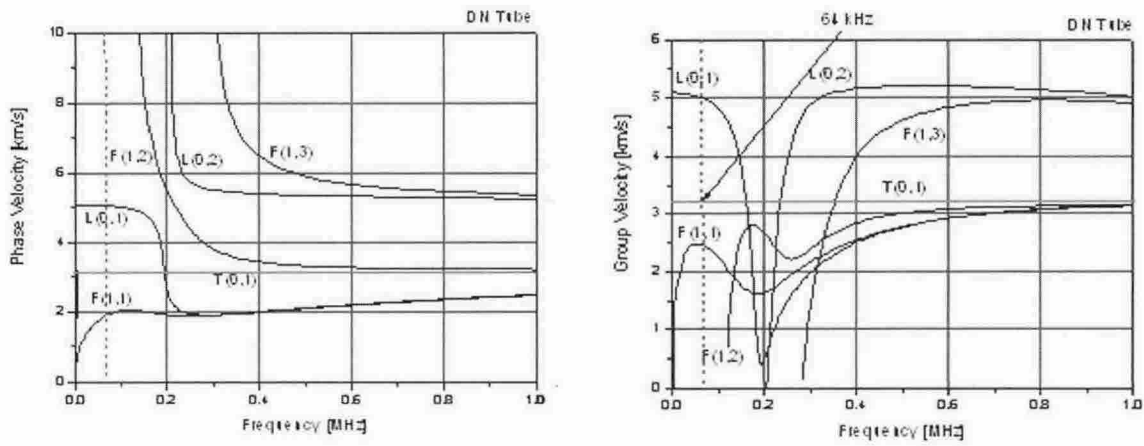


Fig. 1 The phase velocity dispersion curve and group velocity dispersion curve for a small bore tube with OD of 3/8 inch and thickness of 0.04 inch.

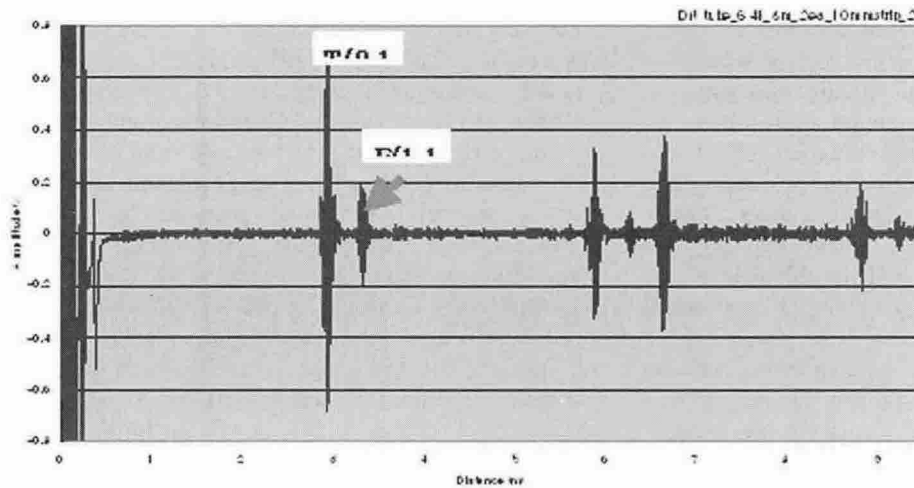


Fig. 2 A typical example of signals from a 3 m long small bore tube.