Abstract:

This paper describes JFE original ultrasonic testing (UT) technologies in Non-destructive inspection (NDI) systems that assure quality of JFE Steel pipe products. To enhance signal-to-noise ratio of UT, the high-speed digital signal processing techniques of synchronous averaging and chirp pulse compression have been developed and installed in ultrasonic flaw detectors of welding pipe. In order to improve detectability of flaws located at middle of wall thickness of weld, the normal incident beam technique for UOE pipe and the multi-probe technique for ERW pipe have been developed respectively. The analysis technique of ultrasonic field and that of ultrasonic wave propagation are applied as basic technology for the developments.

1. Introduction

Nondestructive inspection (NDI) technology is a core technology for inspection/quality assurance of steel pipe products. It also plays an indispensable role as a quality measurement method in process control for stable production of high quality products. JFE Steel therefore assigned NDI technology a position as a critical technologies from an early date, and has carried out development to improve NDI performance and introduced the advanced NDI technologies. In particular, in recent years, users' inspection needs have become increasing strict due to the diversification of steel pipe products and expanded range of applications, and at the same time, heightened requirements have been placed on quality measurement accompanying the use of more advanced production processes. JFE Steel has responded to these challenges by further strengthening its outstanding development system.

This paper describes original high accuracy, high reliability NDI technologies developed to date by JFE Steel and JFE R&D, with special emphasis on the com-

an extreme increase in sensitivity becomes necessary. This invites problems such as false indications and is undesirable from the viewpoint of operation.

In contrast, the multi-probe UT technique was developed to enable tandem probe inspection simultaneously with all channels using angles probes arranged continuously with 8 channels on one side, and is a f aw detection technique which possesses a high detection capacity for f aws in the center of thickness, and at the same time, has the feature of high stability with respect to deviation in the seam position.

3.2 Principle of Full-thickness Inspection by Multi-probe Technique

The probe arrangement used with this technique is shown in **Fig. 8**. Eight 45° angle probes are arranged respectively on each of the two sides of the weld. The fact that these eight units on one side perform simul taneous transmitting-simultaneous signal receiving is the key point of this technique, as this allows n al r Te k ! smi° 4 gle 4 eyŃ eeŞl ≠ e ŞŞ ≠ yŃ c Ş

calculation can be performed within several seconds