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Improved Ultrasonic Offshore Oil Pipeline Thickness Accurate Detection Using Hilbert-Huang Transform and Elman Neural Network

[Qi Zhang](#)¹⁾ and [Peiwen Que](#)¹⁾

1) Inst. of Automatic Detection, Dept. of Information Measurement Technology & Instruments, Shanghai Jiaotong University

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Pipeline flaw detection and safety evaluation are very important because of internal corrosion usually caused by the presence of the water (salty or not), and external damage by anchors or other equipment. Any possibility of leakage must be detected before leakage occurs and preventive action should be taken to avoid losses of oil and ecological disasters. The ultrasonic method is the most commonly used to detect material loss and/or cracking of the pipeline. The ultrasonic intelligent pig is used to detect the pipeline thickness, but the complicated offshore and pipeline environment, especially the variable sensor lift-off (distance between ultrasonic probe and pipeline wall under detection), reduces the accuracy of pipeline thickness measurement. The Hilbert-Huang transform was used to extract the signal features, then the Elman neural network applied to eliminate the effect of lift-off variation to improve the flaw detection accuracy. Experiments showed that the accuracy of detected time of flight between the transmitted pulse and echo from the pipeline wall as well as the thickness of the pipeline wall were clearly improved.

Keywords: [Elman neural network](#), [Hilbert-Huang transform](#), [Feature extraction](#), [Thickness detection](#)

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