77th IIW Annual Assembly and International Conference on Welding and Joining
7-12 July 2024
Rhodes, Greece

OP 478

Dual-Channel Limited Penetrable Visibility Algorithm for Acoustic Emission of Pipeline Weld Crack Leakage Quantitative Monitoring

Jing Huang[1,2], Zhifen Zhang[1,2], Rui Qin[1,2], Guangrui Wen[1,2]
[1]*National Key Lab of Aerospace Power System and Plasma Technology, Xi'an Jiaotong University, Xi'an, China*
[2]*School of Mechanical Engineering, Xi'an Jiaotong University, Xi'an, China*

The pressure gradient at the nuclear power pipeline weld crack leakage results in varying acoustic emission signals being monitored at the crack's upstream and downstream positions. Using a single sensor for early leakage monitoring presents challenges like low accuracy and poor reliability due to constrained monitoring range. To address these issues, a dual-channel limited penetrable visibility algorithm is proposed. Firstly, the temporal data of upstream and downstream channels are truncated and divided, and the adjacency matrix is calculated. Then, based on the eigenvector centrality of nodes, the importance is sorted, the nodes are eliminated and the new adjacency matrix is obtained. Finally, the inverse ratio of the distance between the acoustic emission sensor and the weld leakage crack center is used as the fusion weight, and the normalized adjacency matrix is combined to obtain a dual-channel visual graph. In this paper, the superiority of the method is proved by experiments on ten weld crack pipelines with different sound source sizes and leakage rates. The results show that the method can detect microleakage as low as 0.18 L/min. Additionally, the dual-channel limited penetrable graph offers interpretable abstract feature extraction, aiding industrial technicians in making informed decisions.