EFFICIENT PREDICTION OF DUCTILE FRACTURE IN FERRITIC STEELS USING ARTIFICAL NEURAL NETWORK

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The safety and dependability of engineering structures, particularly in nuclear power plants, depend on the accurate prediction of ductile fracture in ferritic steels, such as pipelines. Although the Gurson–Tvergaard–Needleman model has demonstrated efficacy in simulating fracture behavior, its parameters are still difficult to determine directly due to its time-consuming nature. This paper uses simulated data from compact tension and single-edge notch tension specimens to investigate an Artificial Neural Network (ANN)-assisted method for effective GTN parameter determination. MATLAB-generated data from finite element analyses is used to train the ANN model, which drastically cuts down on the amount of time needed to predict GTN parameters without sacrificing accuracy. The sensitivity of GTN settings and their impact on crack propagation forecasts are also examined in this paper. The findings demonstrate that the ANN-based approach offers a quicker substitute for traditional methods, opening the door for more useful applications in structural integrity evaluations. The findings provide a basis for optimizing engineering design by incorporating machine learning into fracture mechanics.

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