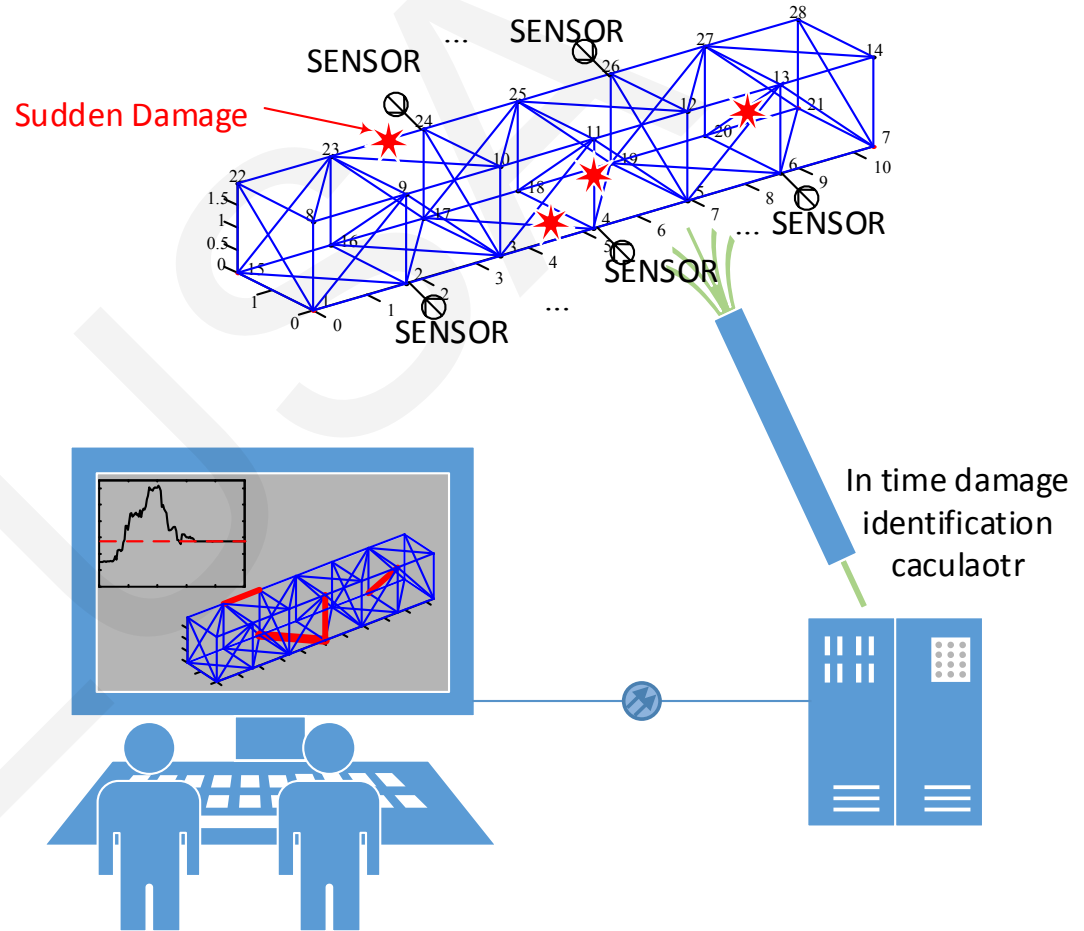


An in-time damage identification approach based on Kalman Filter and Energy Equilibrium Theory

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Concept of In-time Approach



The decision-makers can obtain the damage condition of the structure in a short time and take measures immediately.

Fig. 1 Diagram of process of the in-time damage identification approach

Procedure of In-time Identification

An FE model based on a real world sign support truss in MATLAB was built. It consists of 28 nodes, 83 elements, three of which are set to damaged.

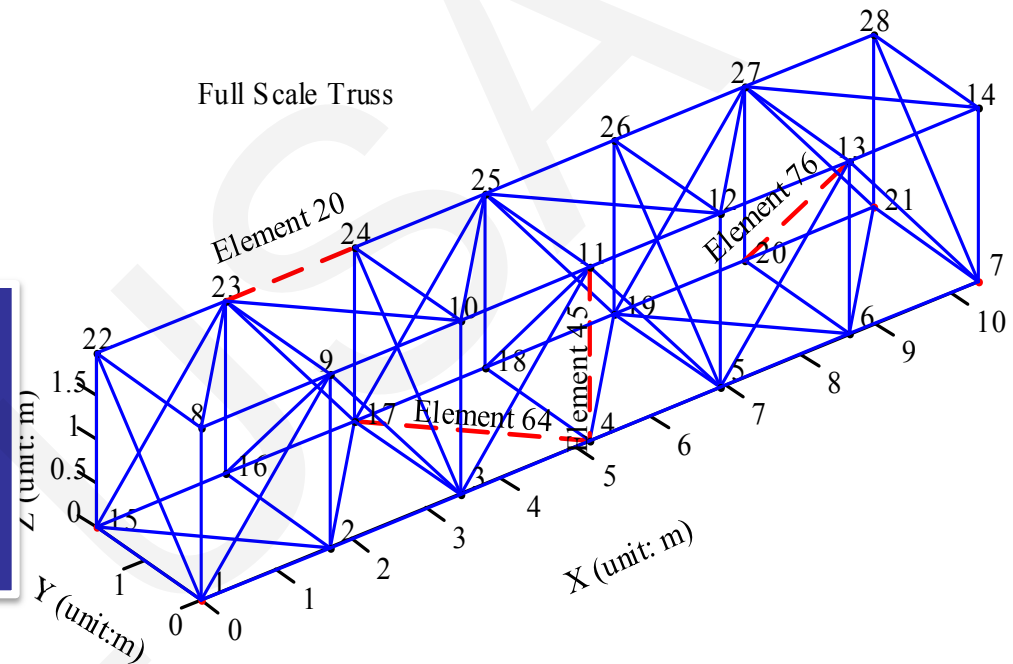


Fig. 2 Finite element model for the 3-D truss in MATLAB and the location of damaged members

Procedure of In-time Identification

■ In-time damage identification without environmental noise

It is clear that the damage identification approach can identify the Young's modulus of the damaged part of the structure in a short time, within 0.4 sec.

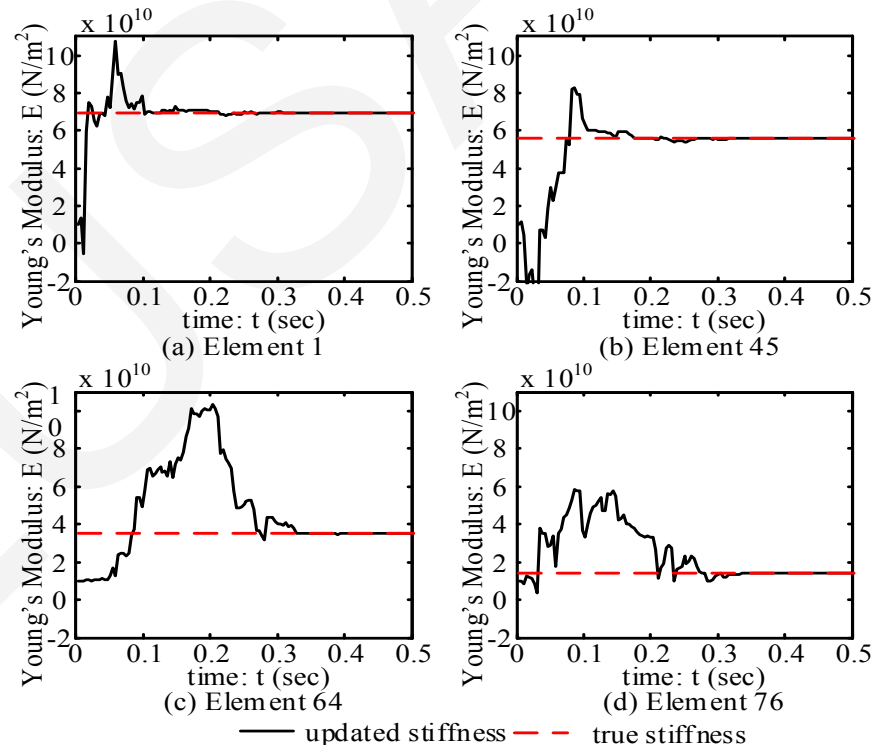


Fig. 3 Process of the damage identification approach Damaged Case 2

Procedure of In-time Identification

■ In-time damage identification with environmental noise

This model updating approach is stable in a noisy environment, specifically the average error is 8.5538% and the maximum error is 15.87%.

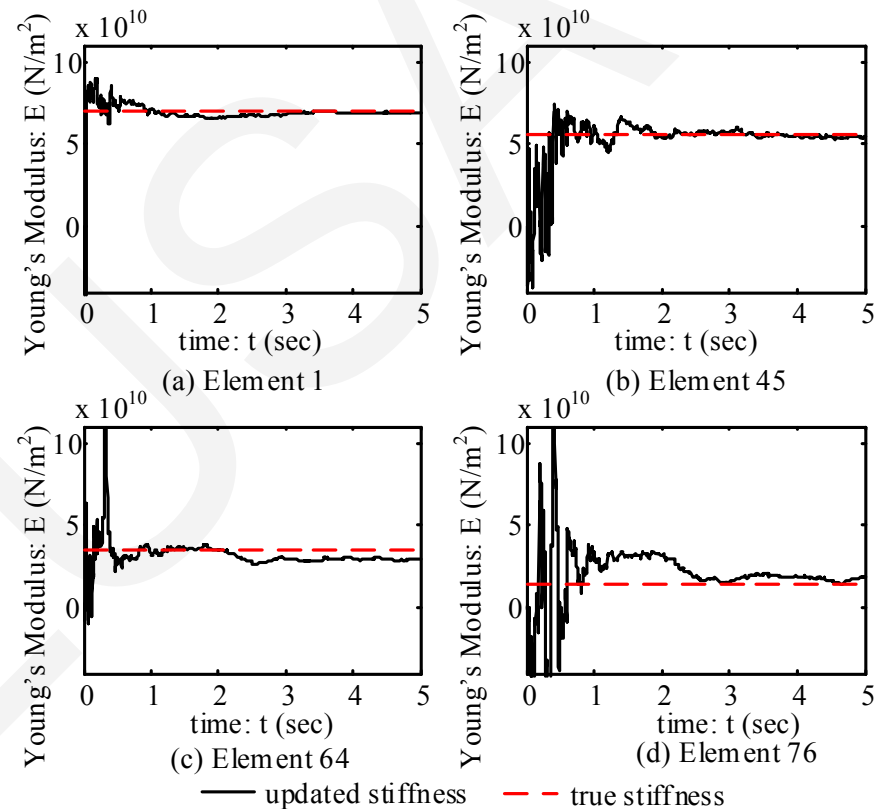


Fig. 4 Process of the damage identification approach with 5% RMS noise

Evaluation of the time consuming

■ In-time damage identification with environmental noise

The time required in each step is always shorter than the sampling period, which means that the damage identification approach is fast enough to update the model and detect the damage in real time.

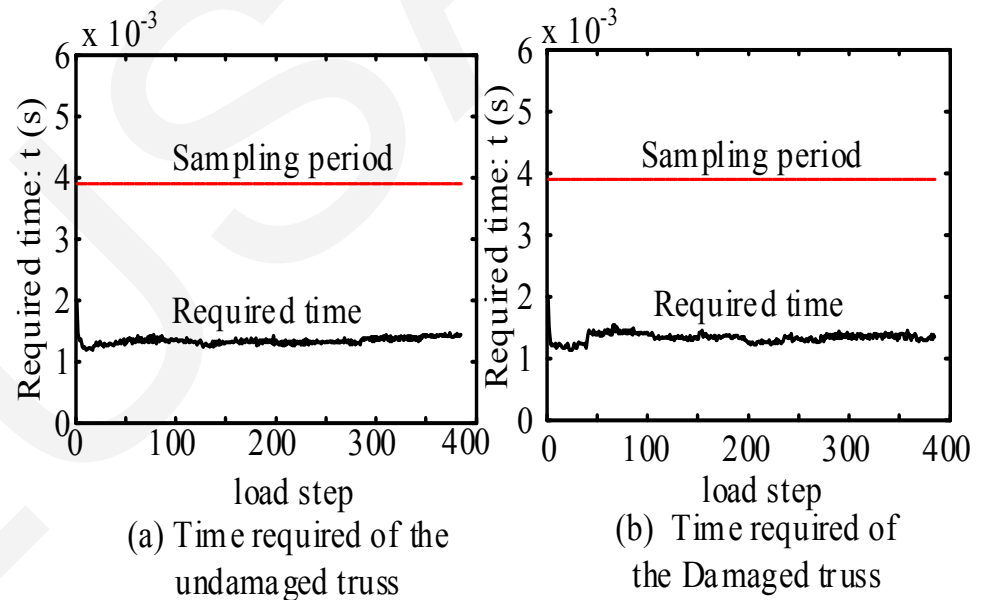


Fig. 5 Comparison between the time required for each time step and sampling period

Conclusions

- The approach can accurately locate the damage at a bar-level and measure the damage intensity.
- The main advantage found during the implementation of this approach is that it is significantly time saving compared to others. The damage identification approach is a method intended to offer a real time result.
- The damage identification approach is also effective in a noisy environment.