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# Stress Redistribution and Modal Parameter Changes in a Steel Truss Bridge

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## 【Background】

A country's economic wellness is dependent on how sound its infrastructures are. With the limited budget in maintaining and monitoring of the infrastructures, bridges for example, novel approaches need to be developed to aid the engineers locate and rectify damage. With the limitation in technology to monitor stress changes in bridges, a numerical approach is useful in trying to investigate and relate these changes to the available vibration data.

## 【Objective】

The relation between changes in modal parameters and stress redistribution due to various damage scenarios hasn't been investigated exhaustively. In this research, a numerical approach was used, where stress and modal changes due to damage were investigated and indicators suggested to quantify even and uneven stress redistribution.

## 【Approach】

An FE bridge model was used and damage induced by removal of some members. The bridge was excited using white noise excitation to get the vibration data for damage detection for each scenario. Static analysis was also done to try and locate damage at various locations. The stress redistribution from the static analysis was then analyzed and compared to modal parameter changes. An indicator based on the percentage change was used to quantify even and uneven stress redistribution

## 【Publication】

**Richard Wanjala, Chul-Woo Kim, Kai-Chun Chang, Numerical Investigations of Vibration-Based Damage Detection in a Steel Truss Bridge , Proc. Of construction steel, JSSC, Vol.23, page 341-348, 2015.11**

## 【Results】

Quantification of even and uneven stress redistribution was done focusing on internal members around a damage. Even stress redistribution (DMG1 & 3) had little effect on modal parameters, thus not easy to detect, unlike uneven stress redistribution (DMG2 & 4). COMAC was accurate in localization of damage, which indicated a link with stress redistribution.

Static analysis on the other hand was able to detect both Uneven and even stress redistribution, and thus may be used in case modal parameters aren't reliable.