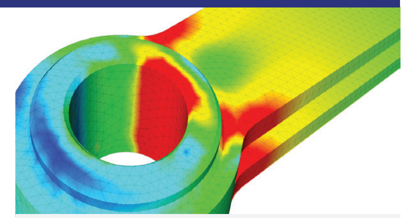
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

ADVANCED FINITE ELEMENT ANALYSIS

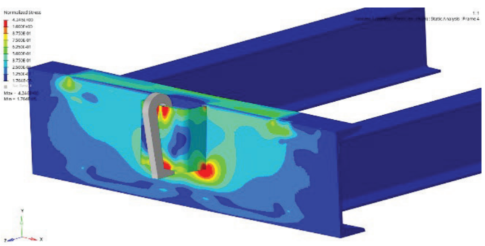


Real Life. Real Tests. Real Benefits.

FINITE ELEMENT METHOD UTILIZING FEA SOFTWARE

The finite element method has become a widely trusted approach for conducting virtual structural analysis. Through continuing advancements, finite element analysis (FEA) software is now available in many forms, including many simple but robust analysis plug-ins that have been integrated into computer-aided drafting (CAD) and 3D modeling packages. However, many industrial-use applications demand higher-level features and functionality than those available through FEA-integrated CAD packages.

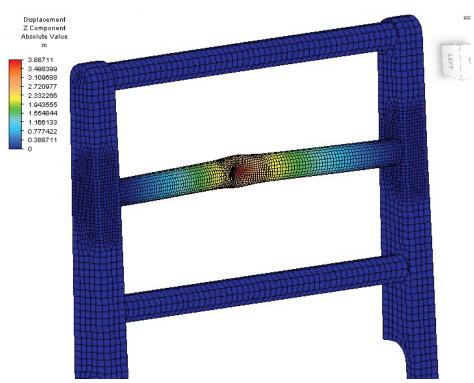
For many years, PAMI has been involved in advanced FEA projects, such as fatigue life predictions and investigations into plastic deformation and the resulting post-yield behaviour. While simulations are a valuable tool during the engineering process, PAMI's extensive testing history provides an added dimension when physical validation is also a requirement. A validated and trusted simulation can be used to model various scenarios well before a final design has been completed, allowing for many iterations and options to be assessed early in the design process. The knowledge gained from modelling these scenarios enables focus on only the most feasible outcomes for physical testing and greatly increases confidence throughout the decision-making process.



PLASTICITY AND POST-YIELD BEHAVIOUR

Many scenarios in industry require an accounting of non-linear effects, such as material plasticity and large deformations. In an investigation to support an OEM manufacturer, these non-linear effects were included and helped to improve the match between prediction and physical testing. Additionally, advanced mesh control aided in predicting accurate through-thickness stress results.

PAMI has a long history of conducting physical testing to support product research and development. At the center of our mechanical testing capabilities is our MTS FlexTest® System. In the work pictured below, highly non-linear FEA that accounted for permanent deformation was validated with physical testing; displacement results agreed within 1.0%.



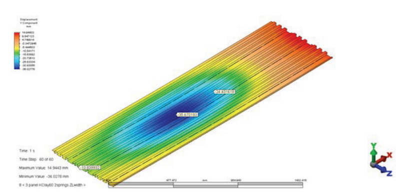
UNDERSTANDING ADVANCED FINITE ELEMENT ANALYSIS

Finite element analysis (FEA) is a computerized method for predicting how a product reacts to real-world forces, vibration, heat, fluid flow, and other physical effects. Finite element analysis shows whether a product will break, wear out, or work the way it was designed.

The finite element method (FEM) is a popular method for numerically solving differential equations arising in engineering and mathematical modeling.

FATIGUE FAILURE EXAMPLE

Fatigue from repeated loading is one of the most common failure modes of in-service machinery across many industries. To understand the service life of a portable track-roadway system, the deformation and strain of components supported by compressible soil was simulated while under load from several vehicle drive-train configurations and weights.



To support FEA model development, actual strain measurements were recorded in multiple locations during multiple passes of a heavy vehicle. Fatigue calculations based on the FEA results were then used to understand and predict component life in the track-roadway system.

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