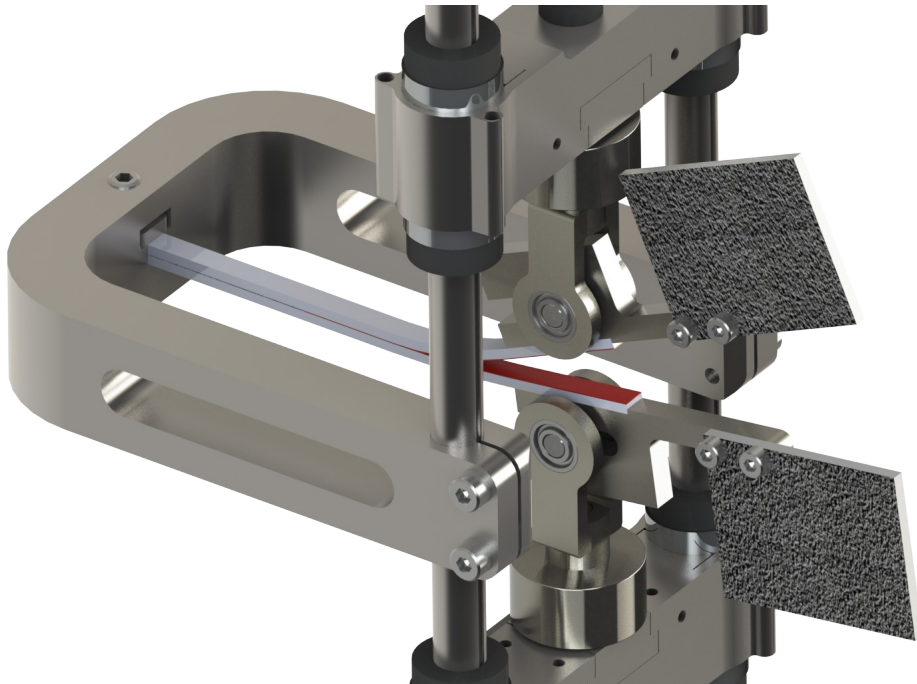


## VISCA\_bond

Adhesives are crucial to modern manufacturing, yet simulating mission-critical structural bonds remains a significant headache. Bondline fracture is complicated by mode-mix, viscoelasticity, temperature, *et. al.* Psylotech introduces an easy to implement, state-of-the-art solution for adhesive bond simulation.

## Mixed Mode Fracture Rig

High fidelity cohesive zone modeling must incorporate mode mix. For *VISCA\_bond*, a special dual actuator version of Psylotech's miniature universal load frame applies any mode mix to a double cantilever beam specimen. Deflection and rotation are measured with digital image correlation from speckle patterned "flags" extending from beam ends. Testing protocols and data analysis software are included in adhesive bond simulation solution.

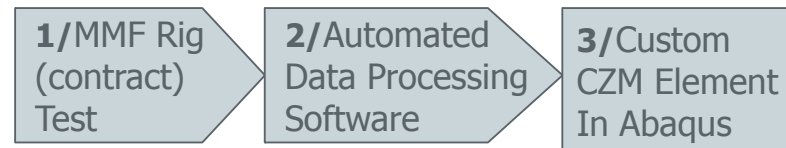


## Direct Traction Separation Law Extraction

The Mixed Mode Fracture (MMF) rig enables direct extraction of Mode I and Mode II traction separation laws. This key advantage over alternative cohesive zone approaches means the relationship between tractions and displacements is not shoehorned into any presumed shape. Instead, the nonlinear fracture process zone specific to a given bonding system is directly measured and implemented in FEA.

## Workflow

The solution quickly plugs into your existing product design process. Abaqus users simply define cohesive zone elements as *VISCA\_bond* elements. The Abaqus workflow is otherwise unchanged.



## Rate, Creep & Temperature Dependence

If all the time dependence resides in the polymer adhesive, Psylotech's *VISCA™* can model bondline viscoelasticity. Note, this assumes the traction separation laws themselves are not viscoelastic. *VISCA™* is Psylotech's polymer simulation solution consisting of **1/a** contract testing service and **2/a** nonlinear viscoelastic Abaqus add-on module. The software module implements a thermodynamics driven reduced time constitutive model, capable of effectively simulating any loading history and any temperature history. *VISCA™* also includes a viscoelastic bulk modulus, which is important when bond thickness is small relative to the transverse dimensions.

## About Psylotech

Psylotech provides instrumentation to inspire simulation. We produce the  $\mu$ TS, a miniature universal load frame designed for the meso scale. Through high precision and a symmetric design, the  $\mu$ TS imparts negligible out of plane motion, keeping images in focus for effective under microscope Digital Image Correlation. It is compatible with optical, confocal and confocal Raman microscopes as well as SEM and AFM.

The  $\mu$ TS is a versatile motion control platform, as realized in the *VISCA\_bond* mixed mode fracture rig. A polymer-specific rig is used for the polymer simulation solution.

## Expert Collaboration

The *VISCA\_bond* Mixed Mode Fracture rig is the evolution of experimental mechanics work done by Prof. Ken Liechti and coworkers over the years. Software to extract traction separation laws as well as the Abaqus user elements also came directly from his group. Ultimately the goal of *VISCA\_bond* is to package his experience into an easy to use software tool.

Professor Liechti has been studying fracture for over 40 years. He is a Fellow of the ASME, AAM, SEM and AS and an Associate Fellow of AIAA. Select awards include the 2015 Adhesion Society/3M Award for Excellence in Adhesion Science and the 2017 Murray Lecture at the Society for Experimental Mechanics.

