Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

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Reinforced Mixed Mode Bending Apparatus

Background

Fracture toughness tests measure the ability of a material to resist propagation of a pre-existing flaw. This is an important material property in the manufacturing industry, since the avoidance of all flaws is not possible. Mixed Mode Bending (MMB) is a previously developed fixture that investigates the fracture toughness of layered materials such as carbon fiber/epoxy composites, glass/epoxy composites, and stitch-bonded composites. However, the accuracy of MMB is affected by the complex data post-processing correction technique, and the inherent compliance in the test fixture introduces error into the fracture energy measurement.

Invention Description

Researchers at Arizona State University have developed the novel Reinforced Mixed Mode Bending Apparatus (RMMBA) to accurately measure fracture properties of new composite, nanocomposites, and engineered materials. The RMMBA was developed using an in-depth analytical model to analyze the load transfer and deformation mechanism to identify the primary source of the system compliance. The superior accuracy of the RMMBA compared to current techniques will allow for a much safer crack-resistant design.

The RMMBA can apply a wide range of mixed-mode ratios that remain consistent throughout crack growth and utilizes simple beam theory equations for analyzing data. By optimizing the design for high stiffness and low weight, much of the error caused by the fixture's compliance is eliminated.

Potential Applications

- Fracture testing of novel materials in the following industries:
  - Space technology
  - Aerospace and defense
  - Energy and nuclear
  - Transportation
  - Sports performance technology
  - Public health

Benefits & Advantages

- 87% increase in stiffness over current techniques
- Reduction in complexity of post-processing calculations
- Increase in accuracy (safer crack-resistant design)
- Allows for materials with a more extensive range of elastic modulus to be tested (e.g., stiffer laminated composites)

Related Publication: Improved Mixed-Mode Bending Test Apparatus through