

Built-in Diagnostics for Sandwich Structures under Extreme Temperatures

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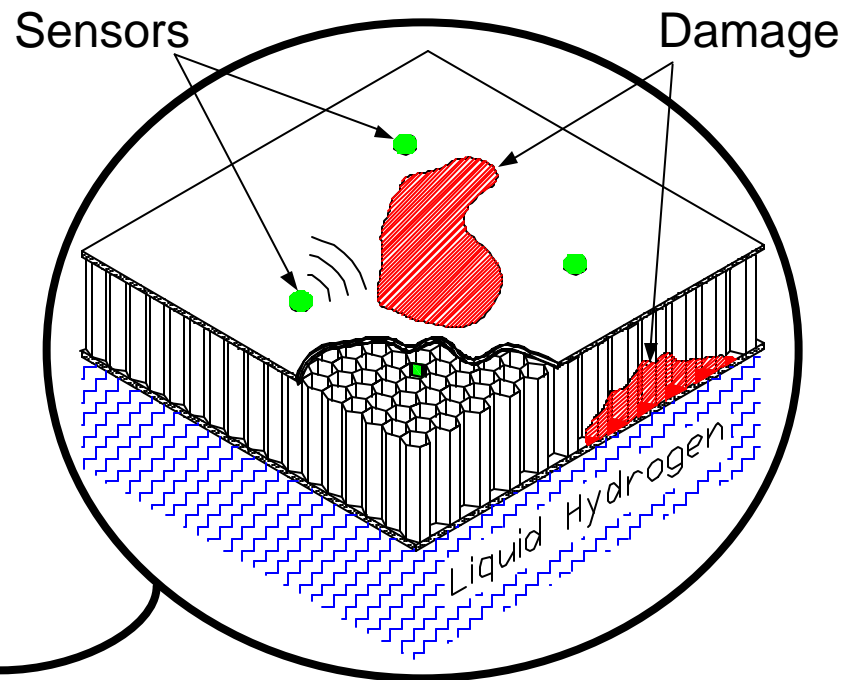
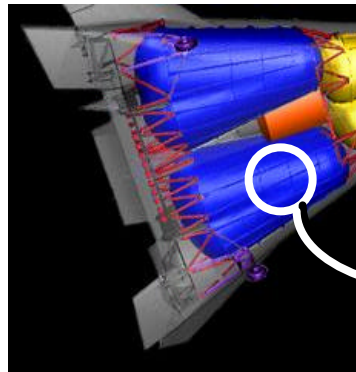
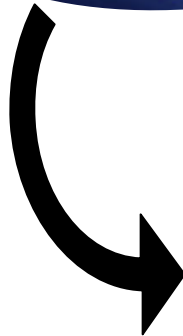
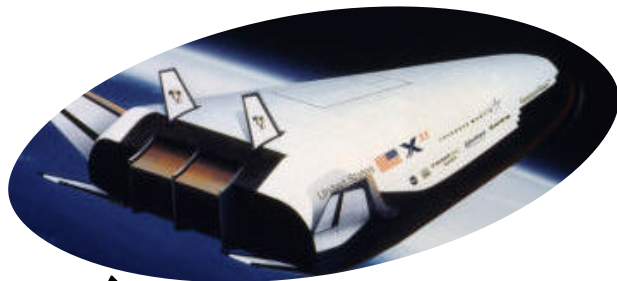
Sponsor: NASA, NSERC

Introduction

- Sandwich structures are widely used in space applications:
 - Satellites.
 - Space station.
 - Space transportation (shuttle, X-33).
- Sandwich structures are susceptible to different types of damage which can lead to catastrophic failure:
 - Debonding.
 - Delamination.
 - Fiber breakage.
 - Core buckling.
- Inspection is difficult and time consuming or even impossible.

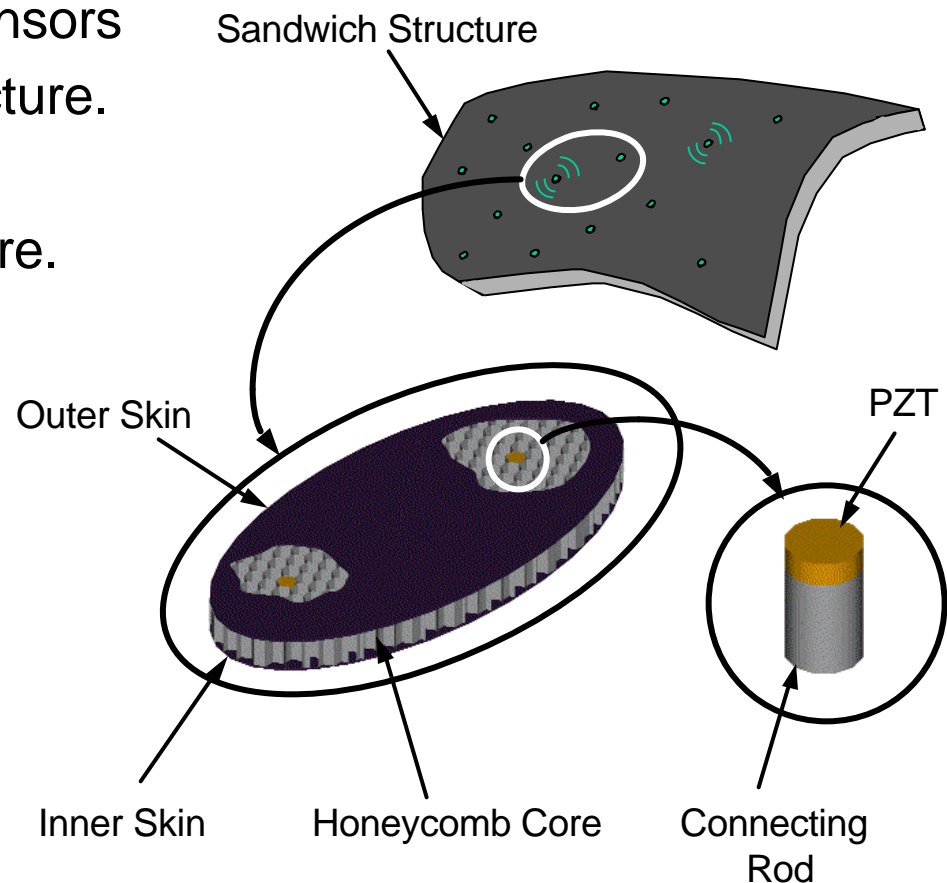
Proposed System

- Integrated network of embedded actuators and sensors

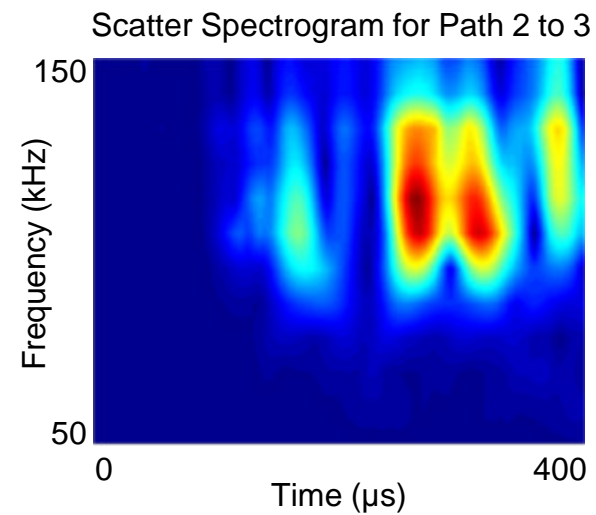
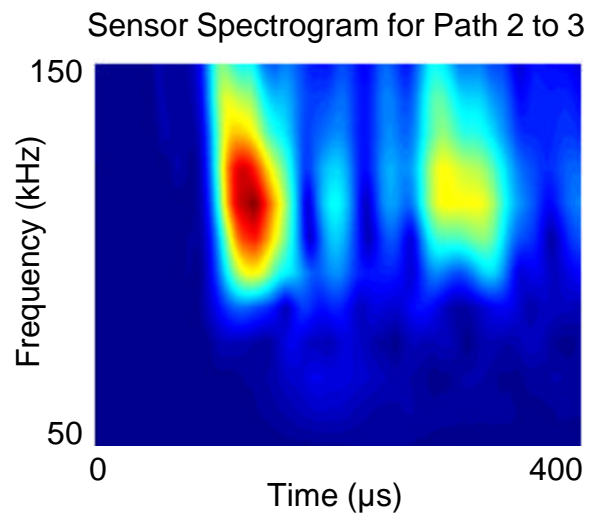
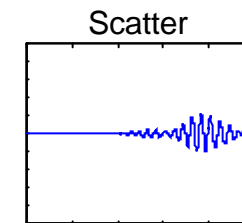
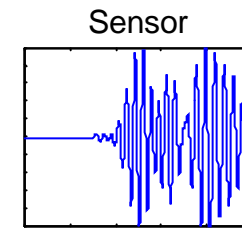
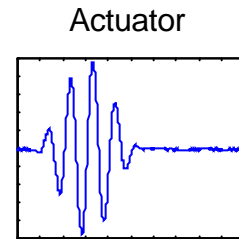
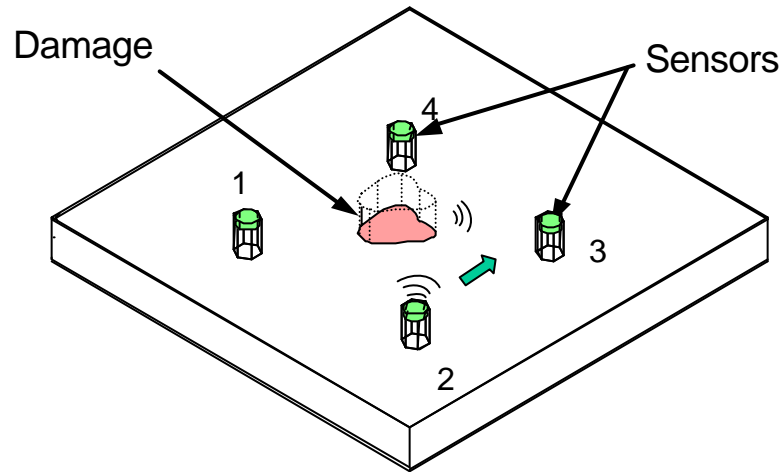


Method of Approach

- Embed actuators and sensors within the sandwich structure.
- Emit a burst wave that propagates in the structure.
- Compare signals before and after damage.
- Use signal processing techniques to evaluate the location and size of the damage.



Results



Effect of Temperature

- Temperature will change the signal amplitude and time of flight.
- Interpolating signals at different temperatures reconstructs the baseline.

