Progressive Failure Analysis for Hybrid Fastening System with Dissimilar Substrates

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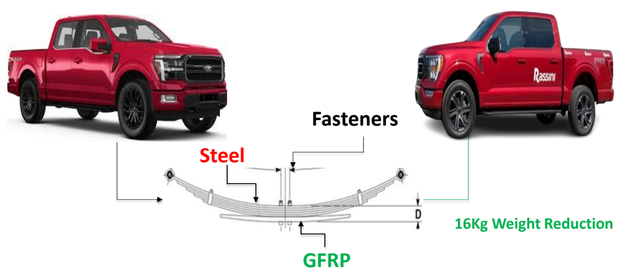
INTRODUCTION

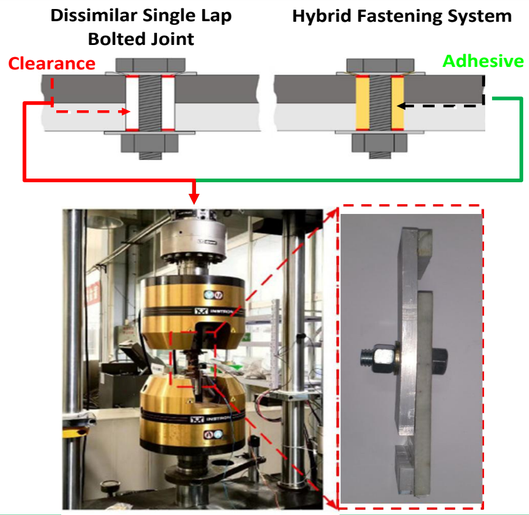
- Mechanical fastening is **inevitable**, allowing versatility in assembly and repair.
- Dissimilar material joining is crucial for **lightweighting** in structural applications.
- Machining holes in composites causes **delamination**, strength reduction, and **stress concentrations**.

MOTIVATION



- Can delamination and slip be mitigated with an adhesive insert?

TECHNICAL APPROACH



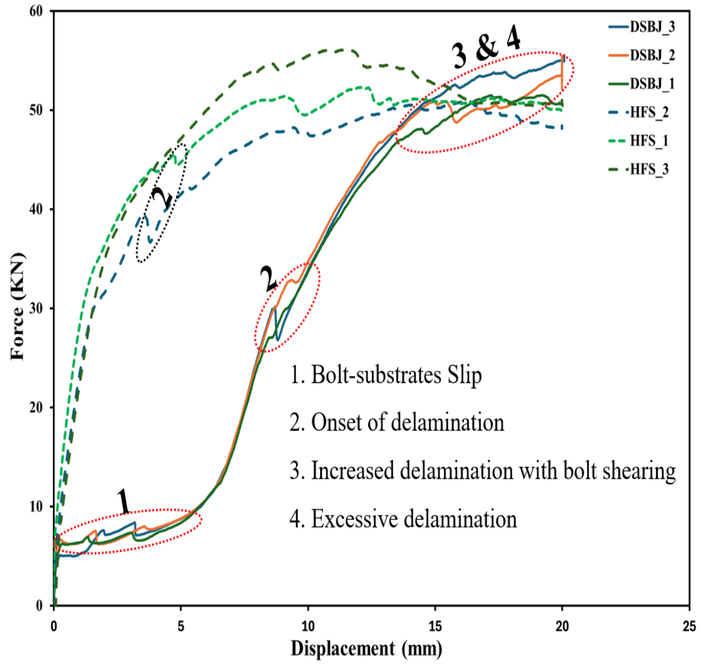
ABSTRACT

❖ To enhance the mechanical behavior of a composite bolted joint (CBJ), structural elements are injected into the bolt-hole clearance, thereby creating a novel joining method termed “Hybrid Fastening Systems” (HFS).

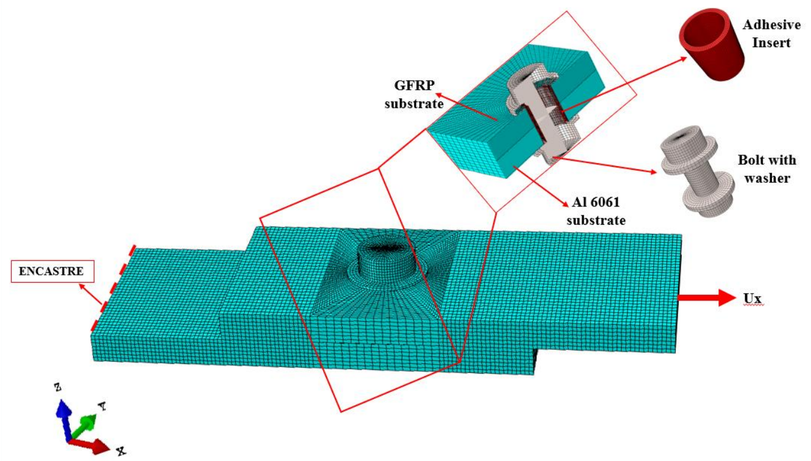
❖ The HFS with dissimilar substrates was subjected to a tensile-shear loading for experimental analysis. In numerical simulations, the composite's intralaminar damage initiation and degradation were modeled using a continuum damage model.

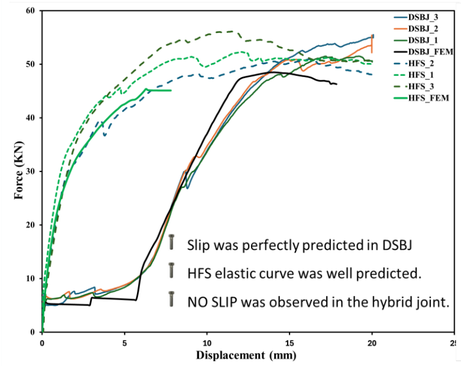
❖ The result indicated that the peak loads of HFS with dissimilar substrates were approximately 9 times higher than the slip loads of conventional dissimilar bolted joints.

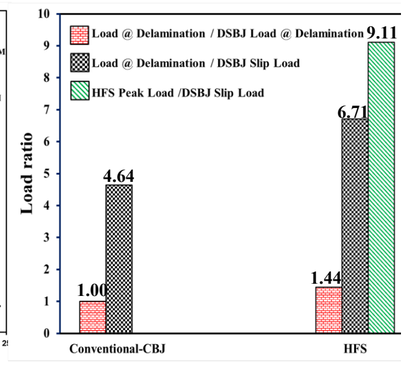
EXPERIMENTAL RESULT



NUMERICAL APPROACH







CONCLUSION & FUTURE WORK

- Initial analyses show that the progressive damage model used in this work shows **good agreement** with experimental data.
- Utilizing SC-15 adhesive as the structural insert in the HFS with dissimilar substrates proved to be **7 -9 times** more effective than the slip load in a dissimilar composite bolted joint.
- This work creates the foundation for numerical modeling of a hybrid fastening system for future work.

References

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Á. Olmedo and C. Santiuste, “On the prediction of bolted single-lap composite joints,” Compos Struct, vol. 94, no. 6, pp. 2110–2117.

Poster's Feedback