



Damage Tolerance and Durability of Adhesively Bonded Composite Structures

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The Joint Advanced Materials and Structures Center of Excellence

Project II: Development of Improved Hybrid Joints for Composite Structures

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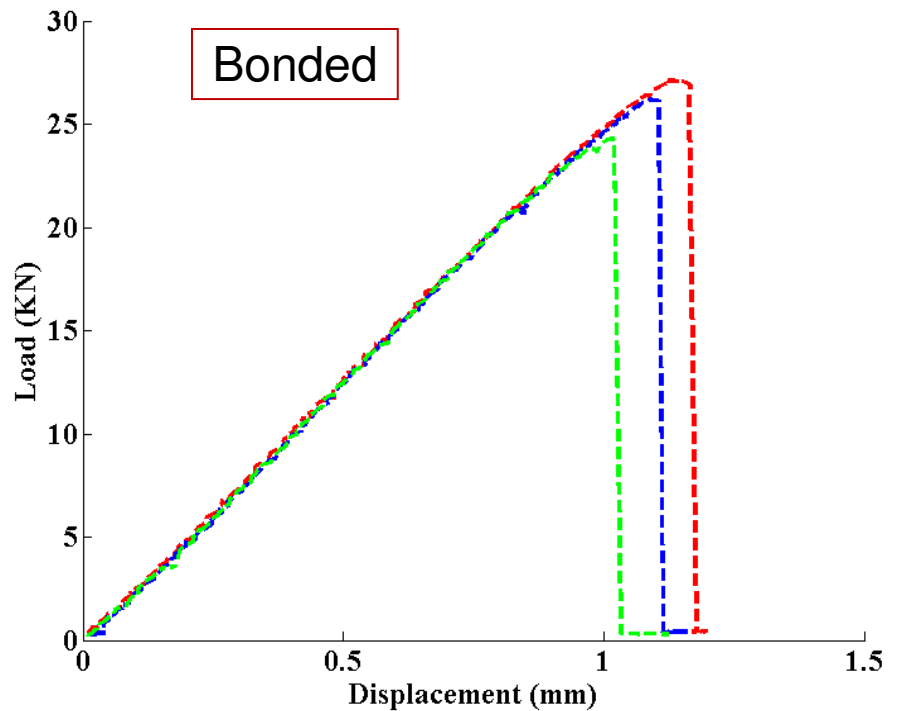
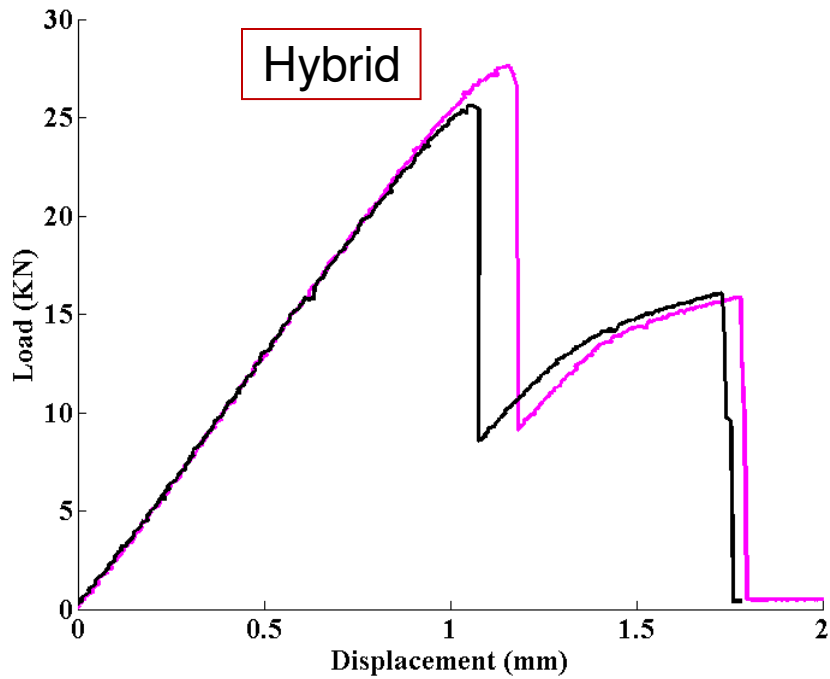
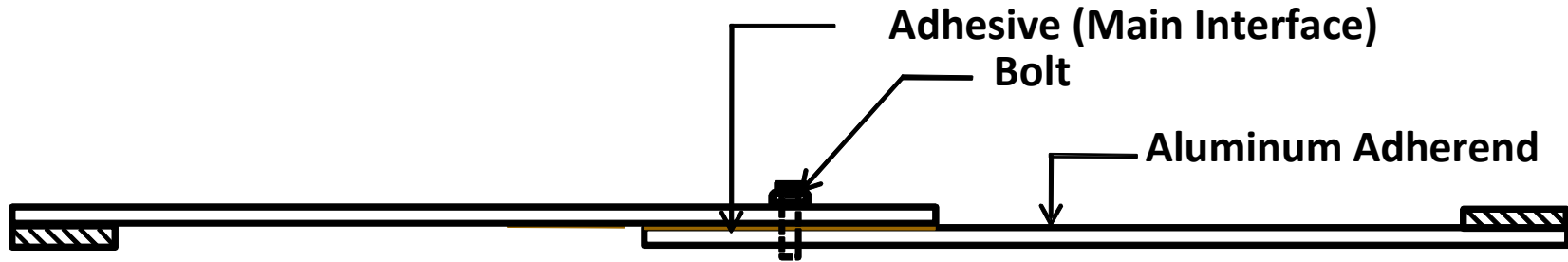
Bhawesh Kumar, Ph.D. Student

Objective – Develop a new hybrid joint using attachments to achieve significantly greater joint strengths

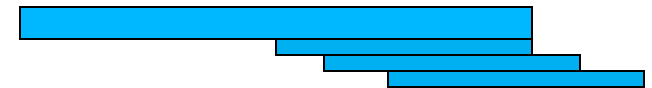
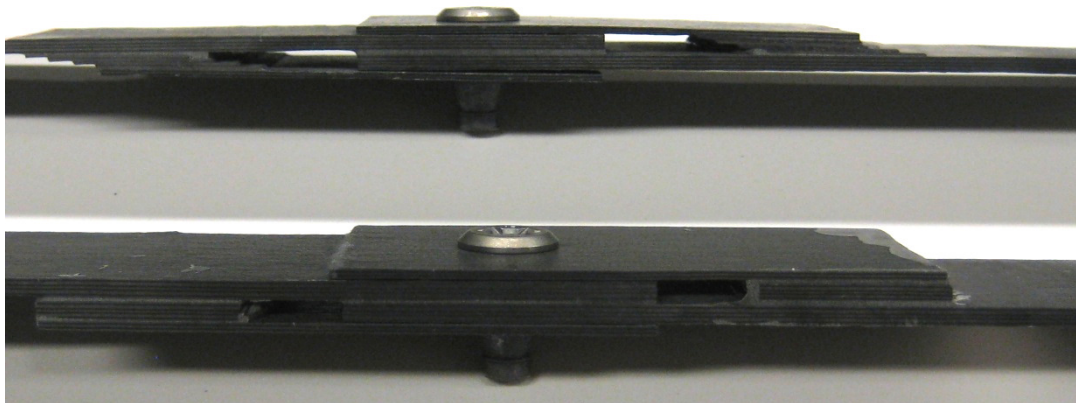
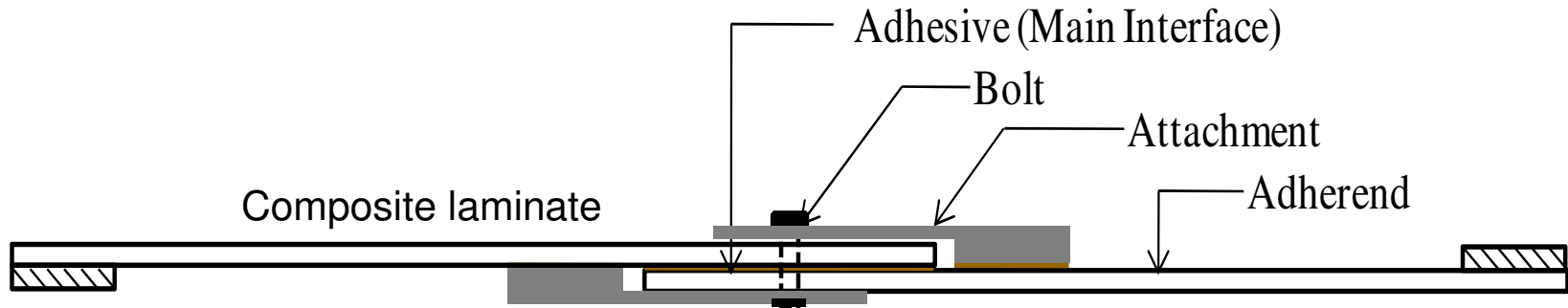
Approach – a new hybrid joint design was proposed for composite lap joints, which use a small flat piece of composite laminate attachment to create an alternate load path to transfer part of the load from the adherend to the bolt

Conventional Hybrid Joint

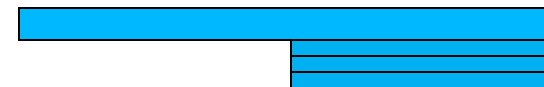
Bolts are idle until adhesive bond fails



New Hybrid Joint with L-shaped and Stepped Attachments

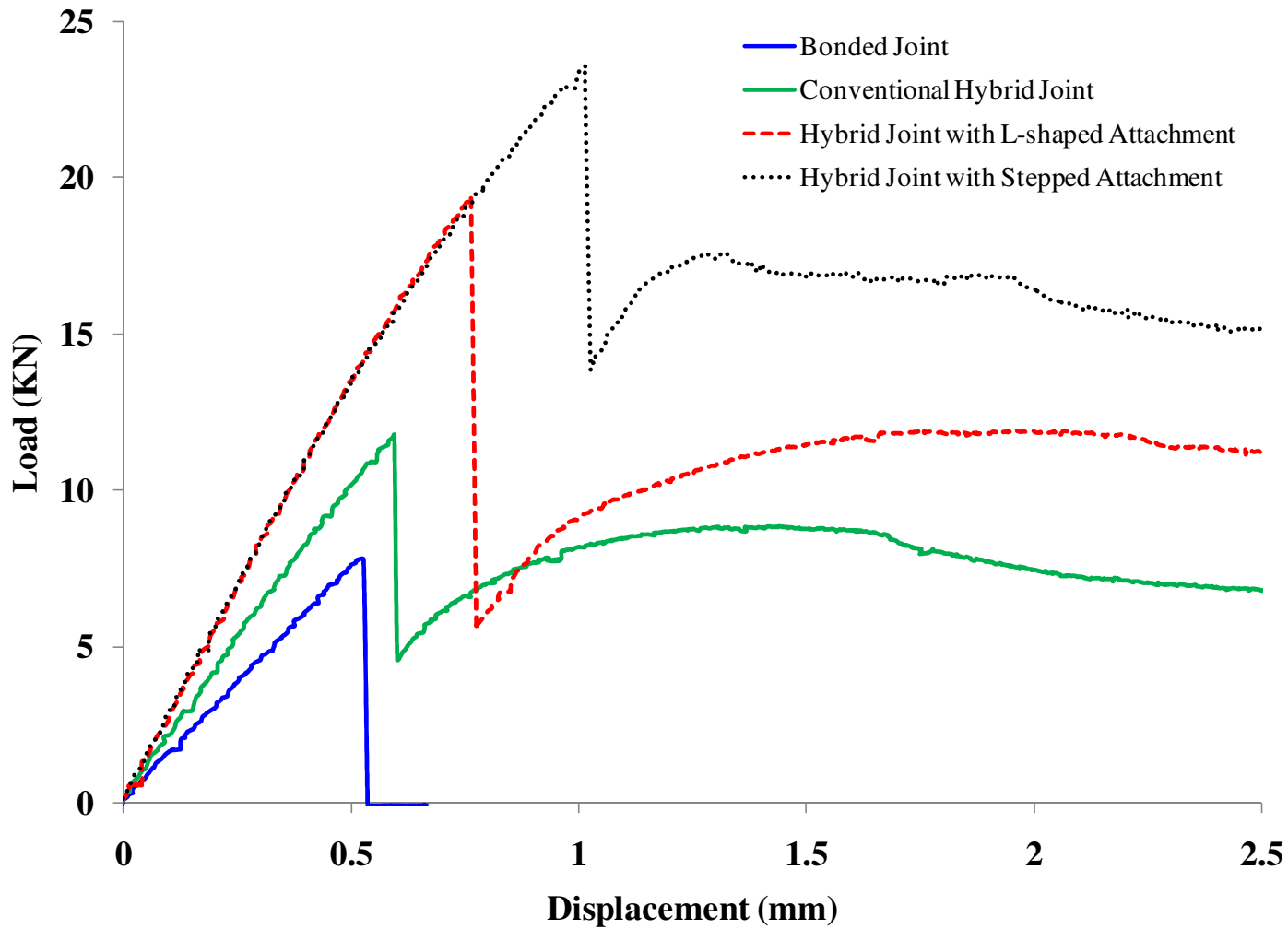


Hybrid joint with Stepped Attachments

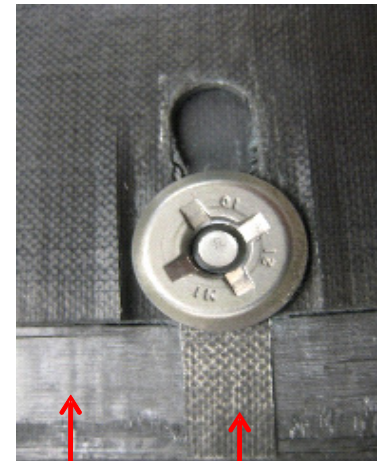
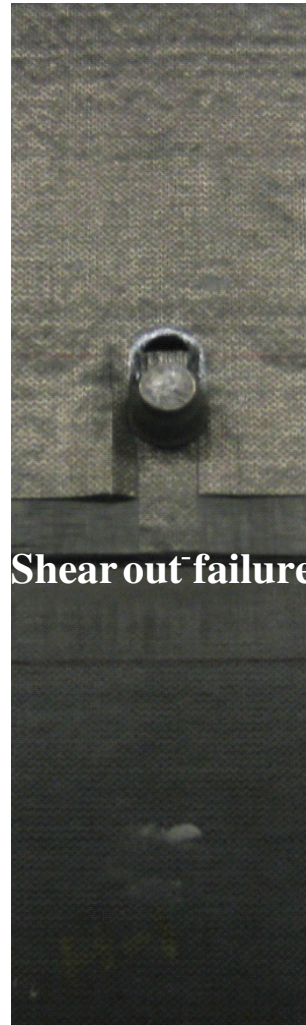


Hybrid joint with L-shaped Attachments

Comparison of Different Joint Designs



Failure Mode in Composite Hybrid Joint

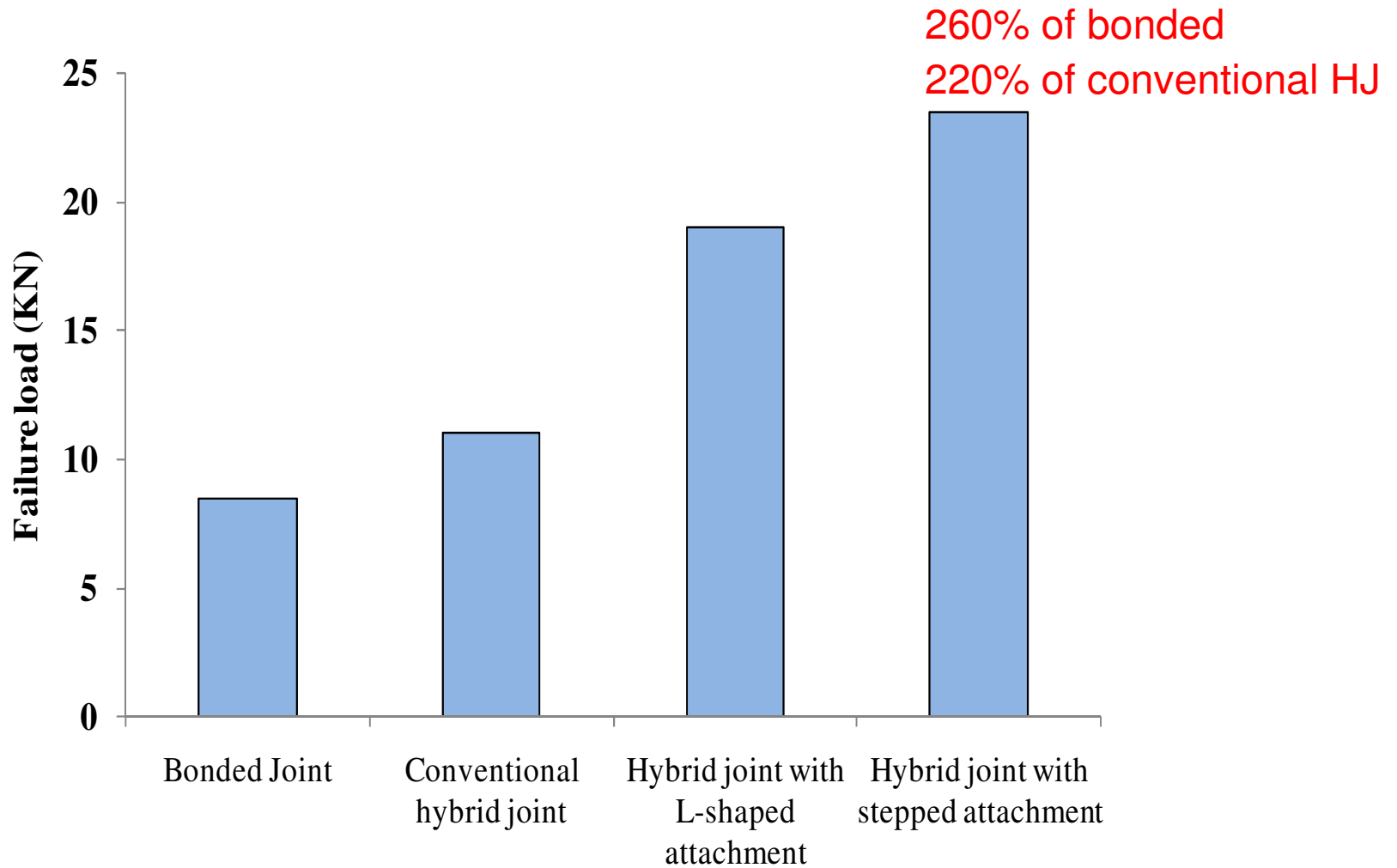


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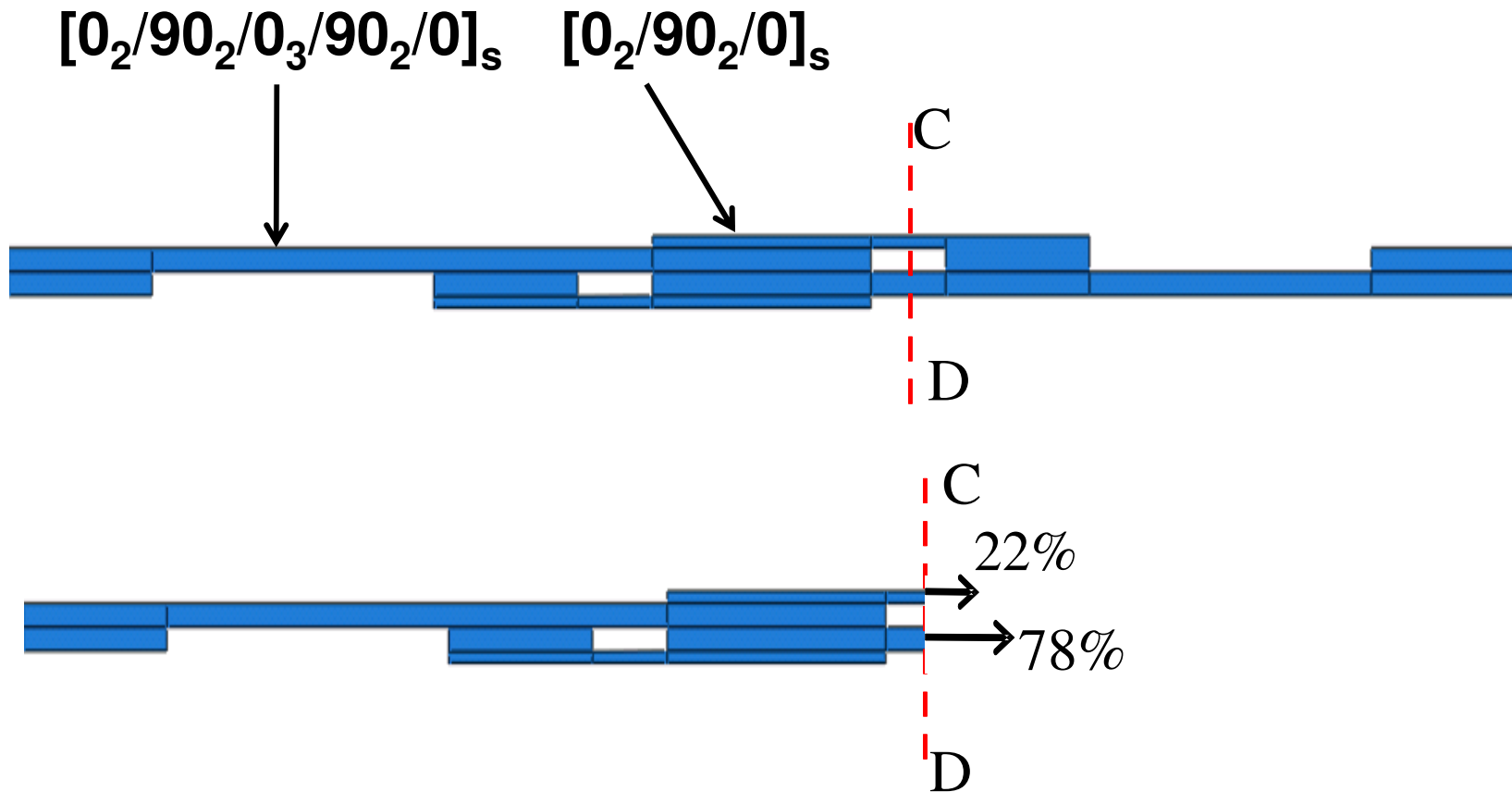
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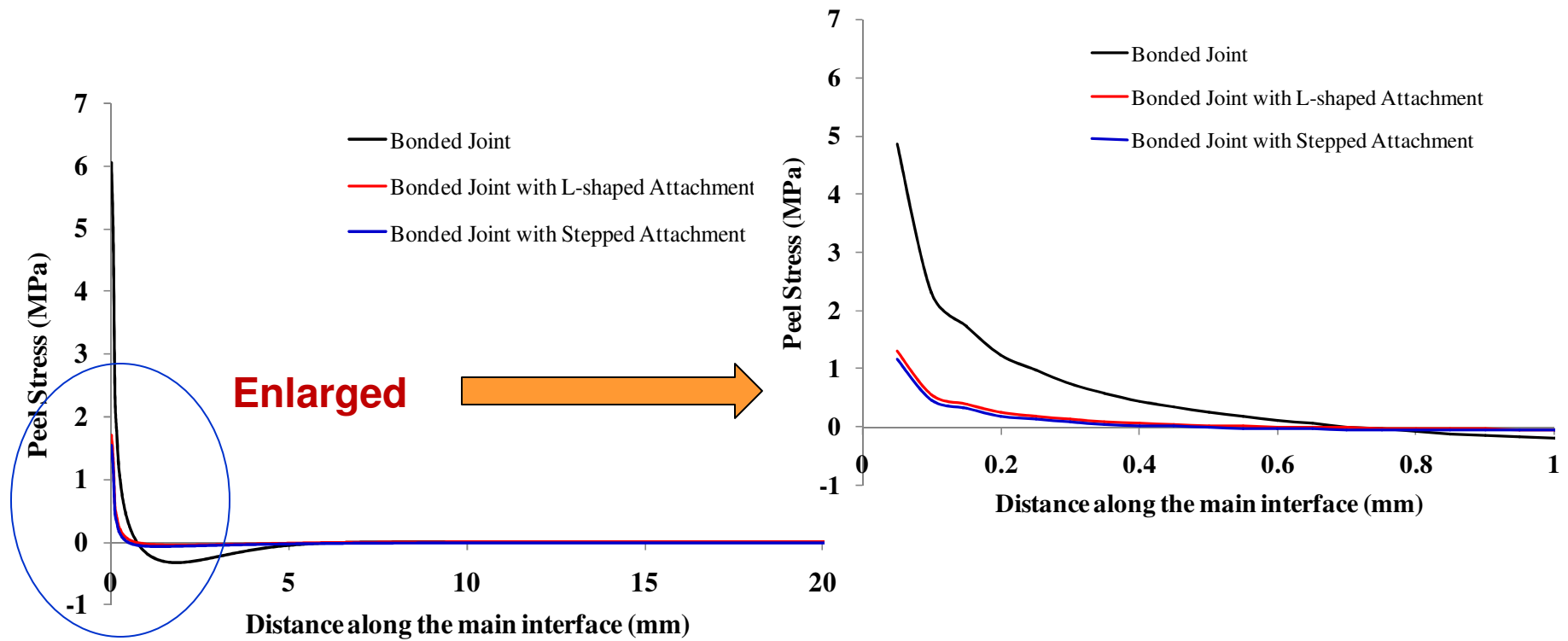
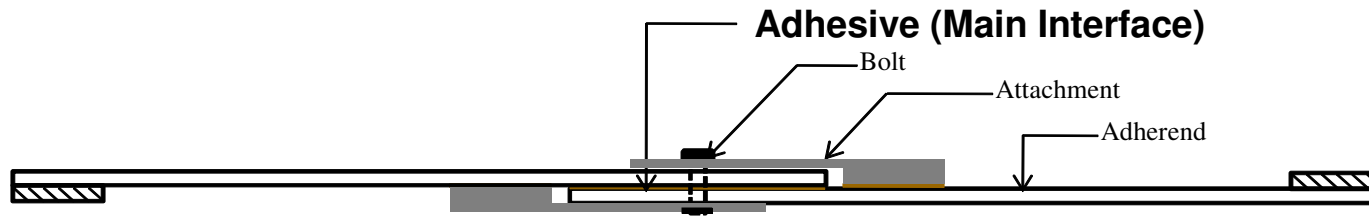
Comparison of Joint Strengths



Distribution of Load between Adherend and Attachment



Effect of Attachment on the Main Interfacial Peel Stress Distribution



Project II Conclusions to Date

- The new design of hybrid joint can invoke the bearing capability of bolts and significantly increase the joint strength from the beginning of its service
- The hybrid joint with stepped attachment further increases the joint strength

A Look Forward



- **Future Needs**

- Future work on the fatigue performance of the new hybrid joint needs to be evaluated.
- Optimal design of the attachment size and composite layup will be studied.
- Fail-safe capability will be investigated.



US Patent is pending

Technology available for licensing

For more details please contact: Eric Lynch at Purdue's
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