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## Title

# Investigation of fluid structure interaction on a flexible cantilevered plate due to shock impingement

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## Abstract

Interactions between shock waves and boundary layers are a well-studied phenomenon [1,2]. Research on SBLI focuses mostly on rigid structures with interactions produced by impinging oblique shocks and compression ramps. Shocks can be generated by several components, including the control surfaces and complicated geometric aspects of vehicles. Vehicle performance is adversely impacted by the shock-induced unsteady loadings. Structures with low stiffness are required to meet the challenge of making lightweight vehicles for hypersonic flows. So, structures are more vulnerable to aeroelastic instability and fluid-structure interactions. When SWBLI is present, it becomes more difficult to study fluid-structure interactions. There needs to be an understanding of how shock wave-boundary layer interactions affect the flow field and structural modes of a deformable panel. Improving the accuracy of aeroelastic modelling tools used in the design of a hypersonic aircraft requires a detailed characterization of these intricate couplings and the provision of data.

Shockwave boundary layer interactions on flexible panels have not been studied much until recently. Spottswood et al. [3] conducted preliminary experiments with a shock impinging on a compliant panel at Mach 2. Willems et al. [4] conducted an experiment in which a shock impinged on a clamped, compliant panel at Mach numbers between 2.5 and 4.5. Improvements in separation length have been reported by Daub et al. [5], which has led to a decrease in separation bubble size and the recommendation of using compliant panels for SBLI control. This work intends to investigate the coupling of shock and structure in a cantilevered plate as opposed to most studies, which have focused on fully clamped panels.

Numerical simulations were performed on a cantilevered plate in a hypersonic flow using ANSYS using system coupling on a flat plate with impinging shock. Mesh, domain size, and timestep independence studies were carried out. The size of the separation bubble will be compared with a rigid case to see how the compliant panel affects the flow field. The effects of free stream conditions and impingement location on separation length are also studied. Detailed results and discussion will be presented in the full paper.

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