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Investigation of Stiffness Derivatives of a Wedge for Varying Wedge Angles and Pivot Positions at Hypersonic Mach Numbers

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Abstract
The current investigation focuses on numerically simulating the stiffness derivative across a wedge by varying Mach numbers and wedge angles at different pivot points. The simulation of the stiffness derivative utilizes an approach based on regression model analysis. The analytical results draw upon Ghosh's two-dimensional piston theory. This research considers the Mach number, wedge angle, and pivot position as factors. This study's Mach number (M) ranges from 5.0 to 10. 0 while the wedge angle (θ) varies between 3° and 30°. The stiffness derivative findings are obtained for Mach numbers (M) and angles of incidence (θ) at several pivot positions (h) spanning from 0. 0 to 1.0. The findings of this study regarding stiffness derivatives are compared to the analytical results. There is a strong alignment between the current research results and the analytical findings. It is observed that parameters such as pivot position (h), wedge angle (θ), and Mach number (M) play a significant role in influencing the variations of the stiffness derivative. The stiffness derivative consistently increases with the angle of incidence (θ) and decreases steadily as the Mach number (M) increases at each pivot location (h).

Author Keywords
angle of incidence; hypersonic flow; Mach number; shock wave; stiffness derivative

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