

# **Maximization of Fundamental Frequencies of Axially Compressed Laminated Curved Panels against Fiber Orientation**

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## **Summary**

The applications of fiber-composite laminate materials to aerospace industrial such as spacecraft, high-speed aircraft, missile and satellite have increased rapidly in recent years. The most major components of the aerospace structures are frequently made of curved panels and subjected to various kinds of compressive forces. Therefore, knowledge of the dynamic characteristics of composite laminated curved panels in compression, such as their fundamental natural frequency, is essential. The fundamental natural frequency of composite laminated curved panels highly depends on the ply orientation, end conditions, geometries (i.e., aspect ratio and curvature) and compressive force. Therefore, proper selection of appropriate lamination to maximize the fundamental frequency of composite laminated curved panels in compression becomes a crucial problem.

Research on the subject of structural optimization has been reported by many investigators and has been widely employed to study the dynamic behavior of composite structures. Among various optimization schemes, the golden section method is a simple technique and can be easily programmed for solution on the computer. In this investigation, maximization of the fundamental natural frequency of composite laminated curved panels in compression with respect to fiber orientations is performed by using the golden section method. The fundamental frequencies of the composite laminated curved panels are calculated by using the Abaqus finite element program. In the paper, the constitutive equations for fiber-composite lamina, vibration analysis and golden section method are briefly reviewed. The influence of the end conditions, the panel aspect ratio, the panel curvature and the compressive force on the maximum fundamental natural frequency, the associated optimal fiber orientations and the vibration mode of the laminated curved panels is presented and important conclusions obtained from the study are given.

