Dynamic characteristics of composite tapered tubes

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Keywords : Composites, Tapered tubes, Natural frequency

1. Introduction

Due to high specific stiffness and specific strength as the advantageous features of composite materials, composite structures have been widely used. Among application shapes of the composite structures, tapered tubes made of composite materials have been employed in many applications such as a nozzle of a spacecraft, a pressure vessel, a golf club and so forth. In these structures, vibrational characteristics by dynamic loading play important role in designing the structures. To analyze the vibrational characteristics, many design theories have been investigated. [1-5]
In this study, we examined the vibrational characteristics by performing experimental validation to evaluate dynamic features of the composite tapered tubes under free vibration. In particular, we considered effects of fiber orientation errors during wrapping process of prepregs on dynamic characteristics. To investigate this, we examined their characteristics with and without fiber orientation errors by comparing with theoretical values as well as.

2. Experimental method

The dynamic characteristic evaluation of the composite tapered tubes under free vibration can be categorized into clamped, simply supported, free-free conditions, according to their constraint requirements. In this study, we applied the free-free constraint condition to the structures to measure the natural frequency of the structure.
.s shown in the Fig 1, we hung the composite tapered ıbes by lifting both ends with wires. Then, we applied npact loads with an impact hammer and measured its ıotion with an acceleration sensor. In Table 1, the shape ıformation and properties of samples used in the xperiment are listed. We fabricated composite tapered ıbes with unidirectional carbon fiber epoxy pregregs JSN 150, SK Chemicals, Korea) by vacuum bag egassing methods.

. Results and conclusion

xperimental results show that the first natural frequency f the structures measured experimentally is within the 0% error ranges of their theoretical expectation. And we bserved fiber orientation errors during wrapping process ecreased dynamic characteristics of composite tapered ıbes.

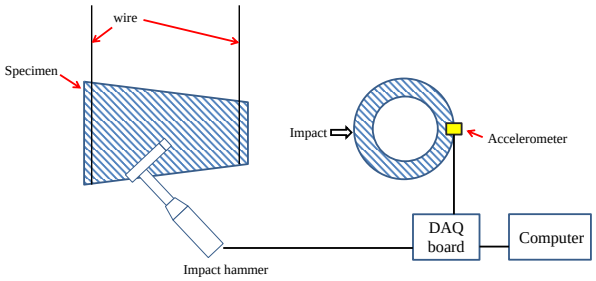

Fig 1. . Schematic figure of impact test for composite tapered tubes

Table 1. Specifications of composite tapered tubes

	Size
R_1	10mm
R_2	15mm, 25mm, 37.5mm
L	150mm
T	0.125mm
Stacking sequence	$[0]_{5t}$

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Excerpt from ISBN 978-3-00-053387-7