形狀記憶合金應用於圓桿波傳的阻抗控制數值模擬

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摘 要

形狀記憶合金(shape memory alloy，簡稱SMA)具有高剛性和良好的阻尼值，其阻抗特性和楊氏係數相關。簡單來說，形狀記憶合金可感測外界溫度的變化而自我改變楊氏係數，這種獨特的可調諧性(tunable)，則是其他金屬所沒有的，因此形狀記憶合金元件可以視為一個穿透能帶(pass-band)的濾波器，經由謹慎的設計後，只允許特定頻寬的振動能量波通過而阻絕掉不要的振動能量，達到阻抗控制、振幅抑制、振能吸收與振動局部化的目的。 在此所使用的分析軟體則為ANSYS內的WORKBENCH，模擬Ni-Ti形狀記憶合金作為波傳阻抗控制的嵌入物，使其與結構產生阻抗不匹配的效果，進而探討圓桿結構之縱向與橫向的振動能，並以三種模擬條件探討形狀記憶合金嵌入物，對於結構內抑制振動能量波的情況：(a)嵌入物楊氏係數的變化；(b)嵌入物長度的變化和(c) 嵌入物位置及分佈情況的變化。 由初步的結果顯示，低頻率的振動較難抑制(橫向第一模態)；高頻率的振動則可有效率的抑制(橫向第二、第三模態與縱向第一模態)。

關鍵詞 : 波傳、阻抗不匹配、減振、形狀記憶合金

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