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Free vibration characteristics of a spinning composite thin-walled beam under hygrothermal environment

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Abstract: This paper focuses on the free vibration characteristics of a spinning composite thin-walled beam under hygrothermal environment. Based on the constitutive relation of single layer material subjected to hygrothermal environment, the dynamic equations of the spinning composite thin-walled beam are built by Hamilton's principle. The solution of the dynamic equations is derived using the Galerkin's method. Numerical simulations are performed to discuss the influences of spinning angular speed, temperature, moisture, length- and thickness-to-radius ratios, and fiber orientation angles on vibration characteristics of spinning composite thin-walled beam. Of particular interest in this process is the combined influence of spinning motion and hygrothermal environment on natural frequencies and critical spinning angular speeds of the beam. The results show that spinning angular speed and hygrothermal environment have remarkable influences on the dynamic characteristics of spinning composite thin-walled beam.

Key words: Hygrothermal environment; Spinning composite thin-walled beam; Free vibration characteristics; Critical spinning angular speeds

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