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Vibration Control of Hermetic Compressors Using Flexible Multi-Body Dynamics Theory

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Abstract : Hermetic compressors are used widely for refrigeration, heat pump, and air conditioning applications. With the improvement of energy conservation and environmental protection requirements, inverter compressors that operates at different speeds have become increasingly attractive in the industry. Although speed change capability is more efficient, passing through resonant frequencies may lead to excessive vibrations. In this work, an integrated vibration control approach based on flexible multi-body dynamics theory is used for optimizing the vibration amplitudes of the compressor at different operating speeds. To examine the compressor vibrations, all the forces and moments exerted on the cylinder block were clarified and minimized using balancers attached to the upper and lower ends of the motor rotor and crankshaft. The vibration response of the system was simulated using Motionview™ software. In addition, mass-spring optimization was adopted to shift the resonant frequencies out of the operating speeds. The modal shapes of the system were studied using Optistruct™ solver. Using this approach, the vibrations were reduced up to 56% through dynamic simulations. The results were in high agreement with various experimental test data. In addition, the vibration resonance problem observed at low speeds was solved by shifting the resonant frequencies through optimization studies.

Keywords : vibration, MBD, compressor, hermetic
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