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# Suppression of Harmonic Vibration in Magnetically Suspended Centrifugal Compressor Using Zero-Phase Odd-Harmonic Repetitive Controller

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Abstract:

Magnetically suspended centrifugal compressor (MSCC) is a better energy-saving choice than ordinary centrifugal compressor in industrial applications. However, harmonic currents, which generate from rotor mass unbalance and sensor runout, cause harmonic vibrations which deteriorate the stability of the overall system and lead to higher power consumption. The conventional repetitive controller (CRC) has been used to eliminate harmonic vibrations in magnetic bearing systems, but the CRC method has the drawbacks of frequency shift and shallow notch depth that degrade its performance of harmonic currents suppression. In this paper, a zero-phase odd repetitive controller (ZORC) is proposed. Compared to the CRC, the ZORC has control action only at odd harmonic frequencies and it has no influence on the closed-loop system at even harmonic frequencies. Besides, the conventional first-order low pass filter is replaced with the zero-phase low pass filter and moved outside the internal loop, which dramatically improve its performance of suppressing harmonic currents. The validity and effectiveness of the proposed method are proved both by simulation and experimental results.

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