Self-sensing active magnetic bearing using real-time duty cycle

采用实时占空比的自传感主动电磁轴承

JZUS C (Comput & Electron)

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- In practical situations, the active magnetic bearing (AMB) system always occurs with the PWM using time-varying duty cycle. Till now, there has been no detailed analysis of the frequency spectrum characteristics of coil voltage and current

- In this analysis, the coil voltage is measured by the eCAP port of DSP in the form of duty cycle. The demodulation process of coil voltage can also be completed in DSP to reduce hardware complexity

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Theoretical analysis:

1. Inductor model of AMB
2. Principle of current mode PWM power amplifier
3. Frequency spectrum characteristic of coil current

Experiment results:

1. Experimental results and analysis of current frequency spectrum
2. Self-sensing scheme using real time duty cycle
3. Bandwidth of the BPF
4. Suspension experiment

Conclusions:

1. The time-varying duty cycle leads to the time varying frequency spectrum of the current
2. The strategy proposed is feasible and the performance of this kind of estimator is satisfactory for self-sensing AMBs

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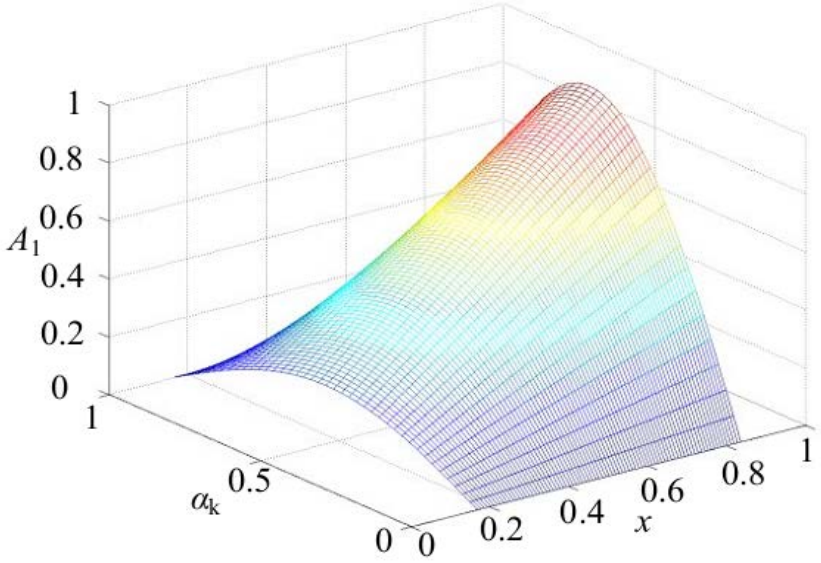


Fig.1 The relationship of current ripple, duty cycle, and air-gap

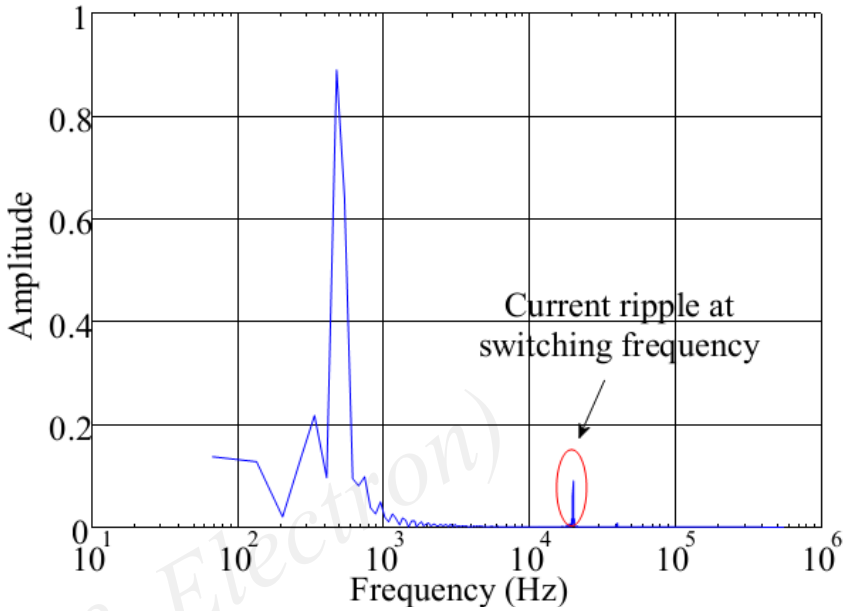


Fig.2 Frequency spectrum characteristic of modulated current

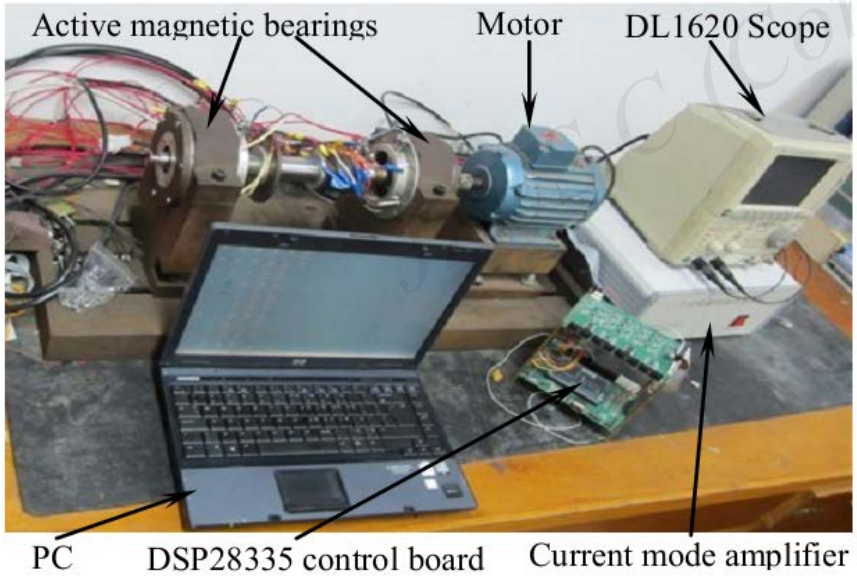


Fig.3 The experiment platform

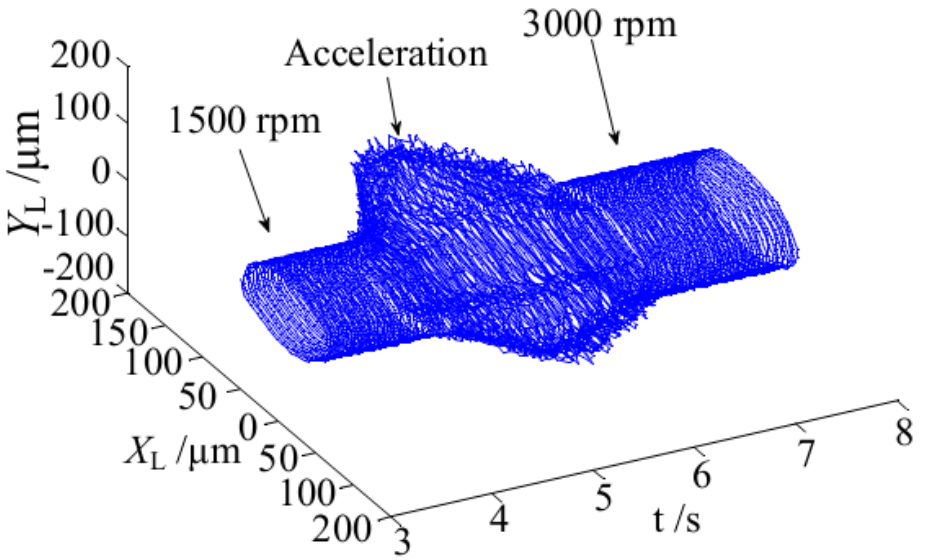


Fig.4 Rotor trajectory accelerated from 1500 to 3000 r/min

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