Abstract

In linear feedback control, the attenuation of disturbances at the designer-selected frequencies is subjected to the fundamental limitation of undesired error amplifications at other frequencies, due to the "waterbed" effect that is induced from Bode’s Integral Theorem. In the presence of unknown disturbances with high-frequency wide-spectrum peaks, such undesired error amplifications severely degrades the closed-loop servo performance, and are extremely difficult to control using traditional loop shaping techniques. In this paper, a direct adaptive control approach is proposed based on adaptive loop shaping and disturbance observer (DOB). The proposed algorithm offers more flexibilities in controlling the "waterbed" effect, to achieve enhanced attenuation of the unknown wide-spectrum disturbances. Verification of the proposed algorithm is provided by simulations of hard disk drives (HDDs) for audio vibration suppression.

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