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Research on Servo Parameter Optimization of FANUC System

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Introduce

After the CNC machine leaves the factory, due to its mechanical fixation, and its accuracy has been basically fixed, the control parameters of the servo drive system can be optimized to further improve the machining accuracy of the CNC machine. In an ideal situation, the drive transfer process of a CNC machine is a linear link (time domain response) with a constant ratio of output to input and no delay. Due to the existence of friction, damping, resonance and other factors of mechanical parts, the transmission process is regarded as a combination of linear and elastic links (frequency response) [1]. The elastic link is the inherent characteristic of the machine tool drive system, is the direct cause of the inflection point frequency of the drive system, which is easy to cause the resonance of the servo drive system, making the processing noise, vibration, jitter and other phenomena in the processing process. Therefore, the optimization of the control parameters of the CNC machine servo system, in addition to the optimization of the three-ring (current ring, speed ring, position ring), also needs to filter the inflection point frequency.

Servo parameter optimization is an important means to improve system stability and machining accuracy [2].

Research Objectives

- By analyzing the principle of frequency response and testing the frequency response of the servo system, identify the high-frequency oscillation points in the Bode plot**.**
- Using filters to eliminate high-frequency oscillation points, increase speed loop gain, reduce time constant, fully utilize the rigidity margin of the servo system, and achieve the goal of optimizing the servo system.

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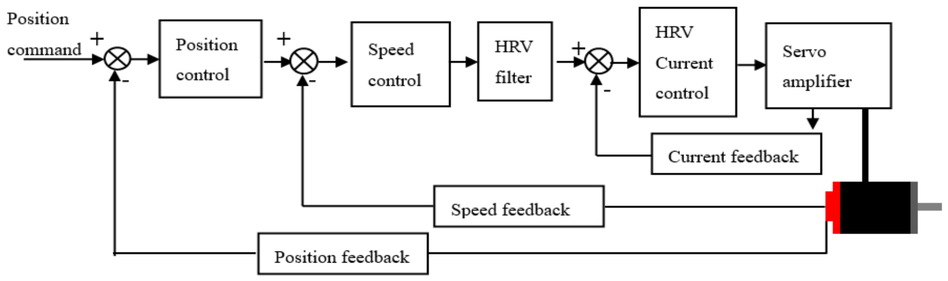
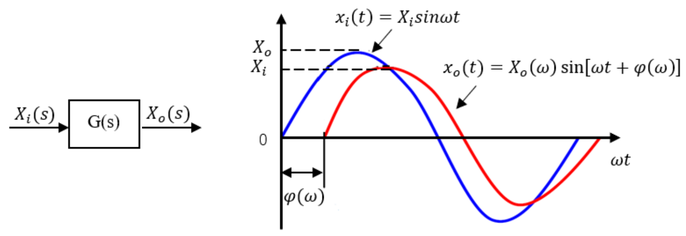
Methods

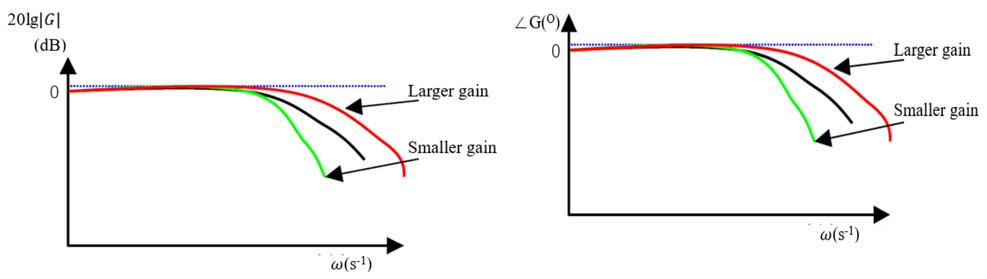
Structure Analysis of FANUC Servo Control System



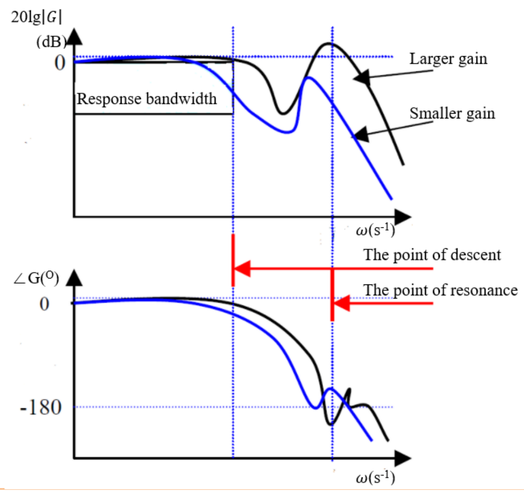
Principle of Frequency Response



System Amplitude-frequency Characteristic and Phase-frequency Characteristic Curve

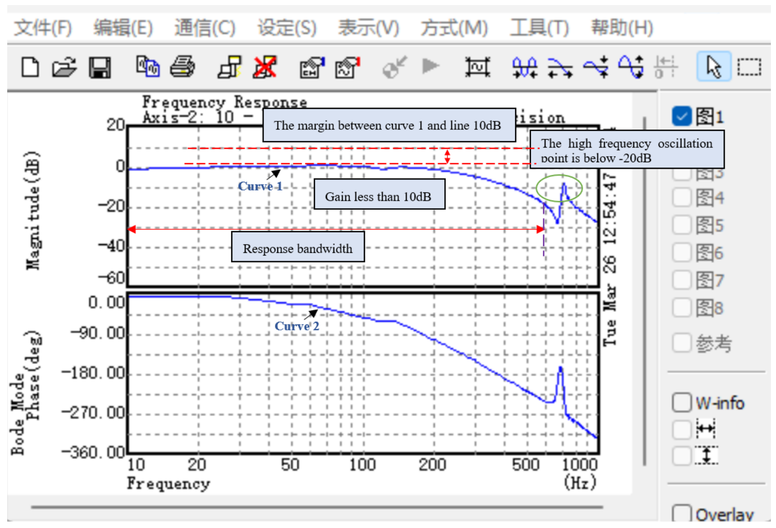


Frequency response characteristic curve of actual machine tool

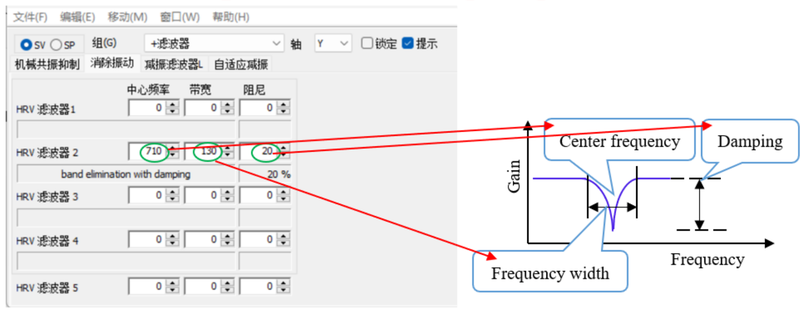


Results

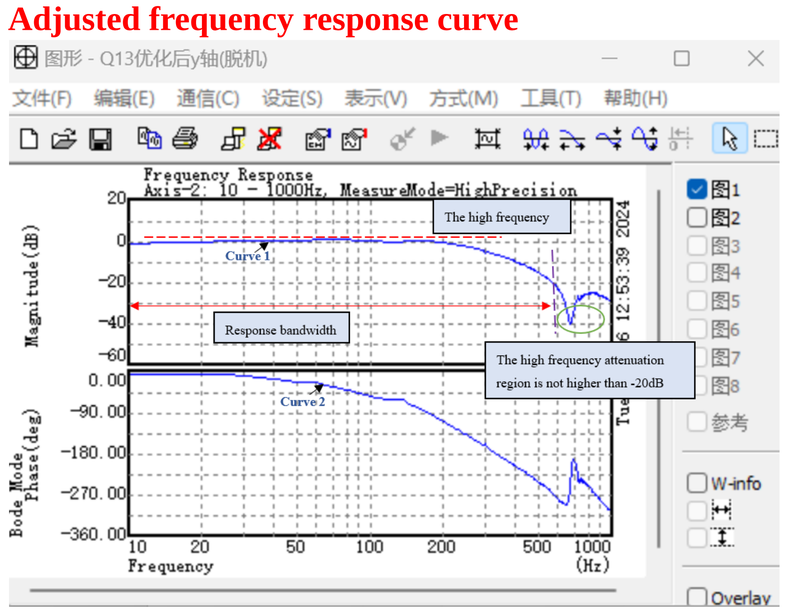
Initial debugging frequency response curve



HRV filter parameter setting diagram



Adjusted frequency response curve



Conclusions

- By analyzing the three-loop control system of FANUC system, the principle of frequency response is analyzed. Taking GRU28IIX40 gantry CNC machine as an example, the frequency response of the Servo system is tested by servo debugging software Servo Guide. The resonant point is identified from the frequency response curve and filtered by HRV filter to improve the speed loop gain, reduce the time constant and give full play to the rigid margin of the servo system.
- Frequency response test is an important means of servo parameter optimization, which can determine the mechanical characteristics of the machine tool according to the waveform of the frequency response curve and carry out the corresponding servo optimization.

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