

Self Tuning Stringed Instrument

Aims:

To design and build a stringed instrument capable of tuning itself

Specifications:

- ◆ maintain functionality
- ◆ maintain aesthetics
- ◆ require minimal user input
- ◆ accuracy comparable to or better than manual tuning

Methodology:

The design was based around a conventional six stringed solid body electric guitar. The task was divided up into two distinct modules; The mechanical system, and the control system. This allowed the task to be simplified and took advantage of the group members' expertise.

Lever System:

A screw-thread attached to the motor slowly alters the force at one end of a lever. The other end is directly attached to the end of the string, altering its tension

String:

The frequency of the string vibration is dependant on the string length, density and tension

Pickup:

The vibration of the string is converted to an electronic signal using a coil wrapped around a magnet

Motor:

The motor direction and speed is determined by the difference between the desired frequency and the measured frequency

Microcontroller:

The period of the signal is determined by averaging the time between consecutive rising and falling edges. The frequency of this signal is the inverse of the period

Filters:

The signal is passed through an amplifier, a band-pass filter and a Schmitt trigger to convert it to a square-wave

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Results:

Under normal playing conditions, the system was able to simultaneously tune each string with an accuracy of $\pm 5\%$ of a semitone, within 10 seconds

Future Work:

- ◆ adapt system to cater for alternate tunings
- ◆ develop a system to automatically resonate strings
- ◆ apply to different stringed instruments

Conclusion:

This system can be easily fitted into a conventional electric guitar, without significantly altering its size and weight. Such a system would be an asset to any stage performer

Figure 1: Closed Loop Control System