

COMPUTER AIDED

DESIGN (MEM620)

Project Documentation

Pneumatic Piston Generator

<04.06.2024>

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**Summary Of the Project:**

This project focuses on creating a consistent voltage utilizing a pneumatic piston under constant air pressure. The pneumatic piston will revolve a wheel acting as an inertial source, while an electric motor attached to the wheel's end will generate and monitor the voltage. The controller will regulate the piston's frequency based on the voltage output, ensuring a stable voltage source immune to fluctuations. Addressing the repercussions of voltage variations in electrical systems—which can harm electronics and cause data loss—a stable voltage source becomes imperative. By employing a pneumatic piston to maintain stability, the project aims to produce and sustain a constant voltage. The rotational speed of the wheel, supported by the tachometer at its end, will be pivotal in achieving a steady voltage output through the connected electric motor. Automated adjustments to the pneumatic piston's operation will be carried out by the controller, relying on speed and voltage readings from the wheel and motor respectively.

**System’s Working Process:**

Firstly, the system basically consists of a piston and an electric motor and gear mechanism connected to it with a reducer. The output of our system is electrical energy and in addition, the output voltage of the system functions as a feedback signal that feeds the feedback mechanism of the system. Basically, after the system gives the first voltage, the piston will start working at a frequency of 4 Hz and its linear movement will be transmitted to the reducer mechanism with rack pinion gears.

Here, we used the freewheel mechanism because we will use only the forward movement of the piston before entering the reducer mechanism and we do not want the movement that occurs during the return. After the freewheel mechanism, our system output will enter the reducer and the appropriate ratio between speed and torque will be changed and we will obtain high speed low torque output. The output of the reducer mechanism will be connected to the shaft of the electric motor and in this way, we will generate DC electricity from the electric motor. Here, it is possible to get the desired level of output by establishing connections and circuits suitable for the output of the motor.

Again, our 5-volt signal, which is the original output of the motor, will enter the microcontroller (STM32F103C8) as an input signal and will provide the appropriate voltage output as output. As it is known, microcontrollers produce output PWM signals with variable duty cycle at constant frequency at the output, and when we take the mean value of this signal, we obtain a DC signal, and we adjust this signal to the frequency we want with the voltage to frequency circuit.

(0-5V => 0.75-4Hz) By driving this signal whose frequency changes with the relay circuit, we control the solenoid valve that controls the pneumatic piston. In this way, the pneumatic system has a microcontroller, a feedback mechanism and an output.

**Systems Parameters:**

Piston operating range: 0-5 cm

Piston operating frequency:0.75-4Hz

Gearbox slewing ratio:1/90

Voltage to Frequency circuit: 0-5V=>0.75-4Hz

Microcontroller: STM32F103C8

**Elektrik kabloları, makine, mühendislik, kablo içeren bir resim

Açıklama otomatik olarak oluşturuldu** **Pictures of the Parts Used in the System:**

Here we have the piston we use and the solenoid valve we control.