Introduction to Soft Robotics

Autumn 2022

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Tutorial 3:
Pumps and valves

Figure 2. Pneumatic system for two PneuNets and MPX5100 pressure sensor using DFROBOT motor driver for Arduino Uno

Code Information

Arduino Code
→ Download ***Pump_valve_simple_control*** sketch at GitHub Link

Arduino Motor controller functions

```
void motor_1_on(int motorspeed);     // Pump 1 activation motor speed range between 0 - 255   --> 0 - 5 Volts
void motor_2_on(int motorspeed);     // Pump 2 activation motor speed range between 0 - 255   --> 0 - 5 Volts
void motor_1_off(void);              // Pump 1 deactivation  (motor speed == 0)
void motor_2_off(void);              // Pump 2 deactivation  (motor speed == 0)

void valve_1_on(void);               // Valve 1 activated -->  5V
void valve_2_on(void);               // Valve 2 activated -->  5V
void valve_1_off(void);              // Valve 1 deactivated -->  0V
void valve_2_off(void);              // Valve 2 deactivated -->  0V
```

Arduino Time Control:
Sample time = 100 [ms]

```
delay(100);     // defining sample time = 100 miliseconds
```

Code Information

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```

Example:

```
//Controlling the time of the process
if (timecounter <= 30)        // 3 seconds == 30 * 100 ms
{
  // Introducion air to the PneuNets
     motor_1_on(250);
     valve_1_on();
     stateprocess=1;


  }
 else if ( timecounter > 30 and timecounter<= 60 )
 {
  motor_1_off();
  valve_1_on();
  stateprocess=2;


  }
```
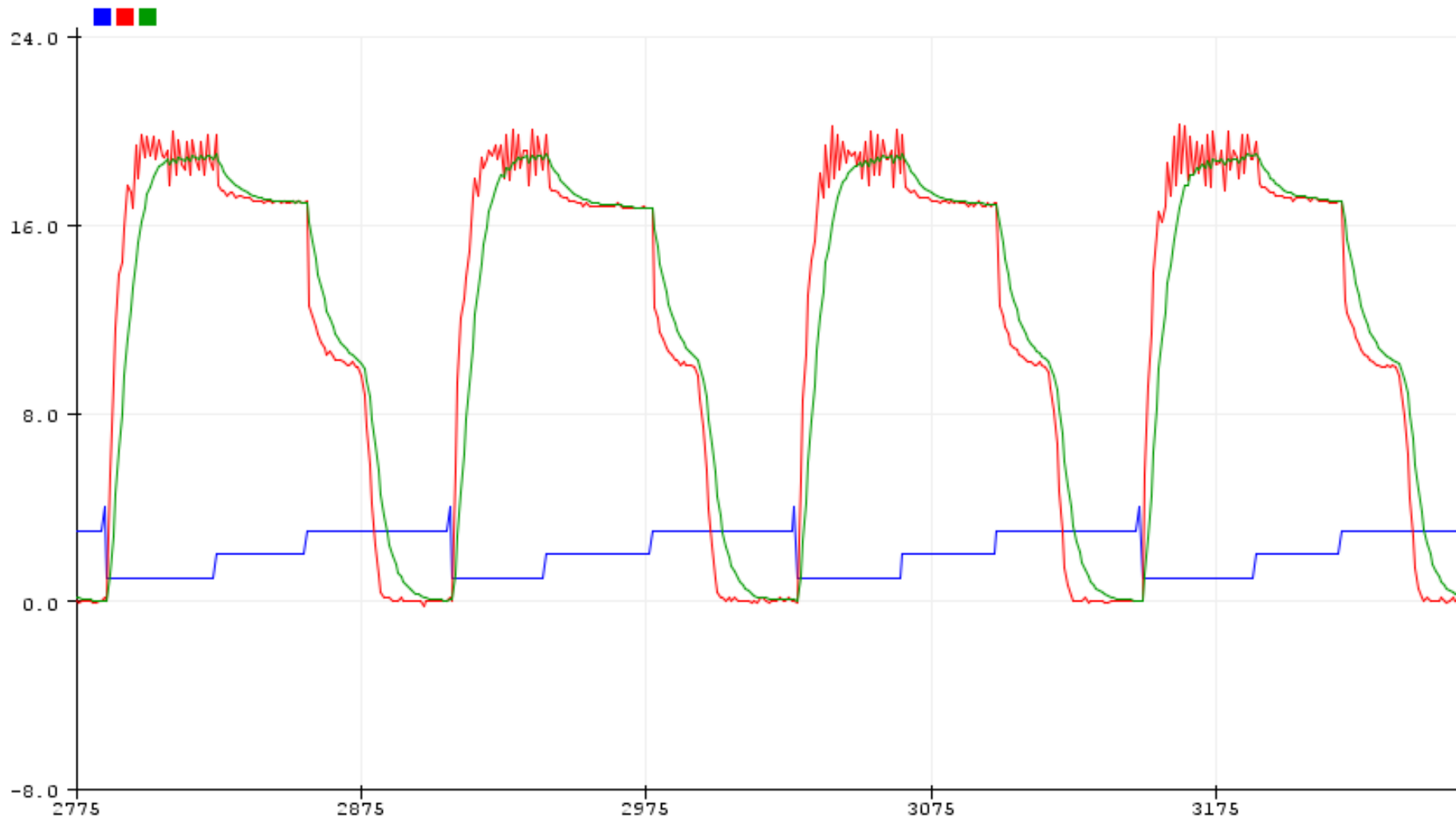
```
else if ( timecounter > 60 and timecounter<= 90)
{
motor_1_off();
valve_1_off();
stateprocess=3;


  }
else if ( timecounter > 90)
{
   timecounter=0;
   stateprocess=4;
   }
```

SDU

Alpha filter

Alpha filter

Alpha filter

```
//Pressure sensor calibration factors  MPX5100 Series Integrated Silicon Pressure Sensor

const float SensorOffset = 4.44;   //pressure sensor offset
const float SensorGain = 0.109;    // pressure sensor proportional relation

//Pressure filter
float pressure=0;
float pressure_f=0;
float pressure_a=0;
float alpha=0.2;
```

```
// filtering sensing pressure status
float  pressure_sensorValue = (analogRead(PRESSURE_SENSOR)*SensorGain-SensorOffset);
pressure=pressure_sensorValue;
pressure_f=pressure_f+alpha*(pressure-pressure_a);
pressure_a=pressure_f;
```

Pressure controller

```
//Controlling the time of the process
if (lock == false )        // Inflation process until reach 20 kPa
{
  // Introducion air to the PneuNets
    motor_1_on(250);
    valve_1_on();
    stateprocess=1;
 }
 if ( pressure_f >= 19 )
 {
 lock=true;
 valve_1_on();
 motor_1_off();
 stateprocess=2;
 }
 else if ( timecounter > 70 and timecounter <= 120 )
 {
 motor_1_off();
 valve_1_off();
 stateprocess=3;
    }
 else if ( timecounter >= 120)
 {
   timecounter=0;
   lock=false;
   stateprocess=4;
   }
```