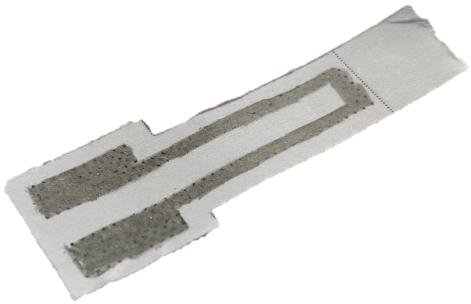
INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

GSS-INSA-2022 v0.2

1 Overview

- graphite strain sensor
- current comsumption 100nA
- low cost and environnmental impact
- short response time



2 Description

- The GSS is a strain sensor made with ultra thin graphites particles. It is a sheet of paper on which you draw a "U" shape with different types of pencils from 9H to 9B.

- This is used to measure either compression of tension strain. This can be seen as a granular system. When you compress the sensor you bring particles closer which reduce the resistance. On the other hand, when you apply a tension, the deformation create gaps between particules which improve the resistance.

3 Schematic

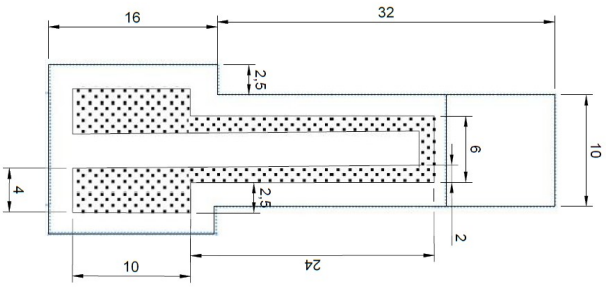


Figure 1: Sensor schematic

Pin	Usage
A	+5V (arduino)
B	A0 (arduino)

Table 1: Sensor connections

4 Specification

Type	Strain sensor with graphite nanoparticles
Materials	Paper graphite (HB pencil)
Power voltage	+5V
Measurand	Voltage
Sensor type	Passive
Strain measure	Resistive
Response time	<200ms
Temperature of use	20±5°C

Table 2: Specifications

Electrical characteristics

	unity	Min value	Max value
Sensor resistance	MΩ	1	1000
Tension	V	0	5

Table 3: electrical characteristics

5 Sensor characteristics

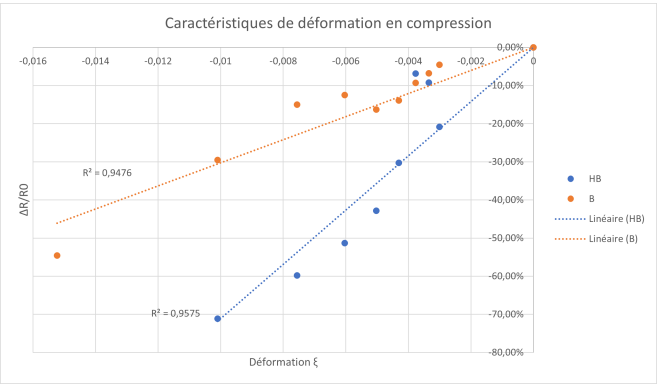


Figure 2: Sensors response, compressive tests

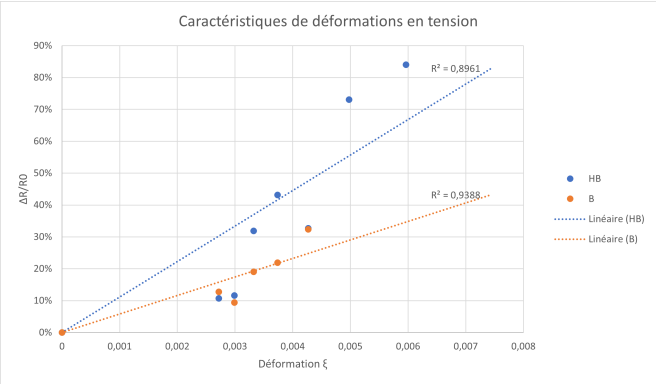


Figure 3: Sensors response, tensile tests

The measure were made with the same sensor beggining with tension and then the compressions tests.

6 Signal processing

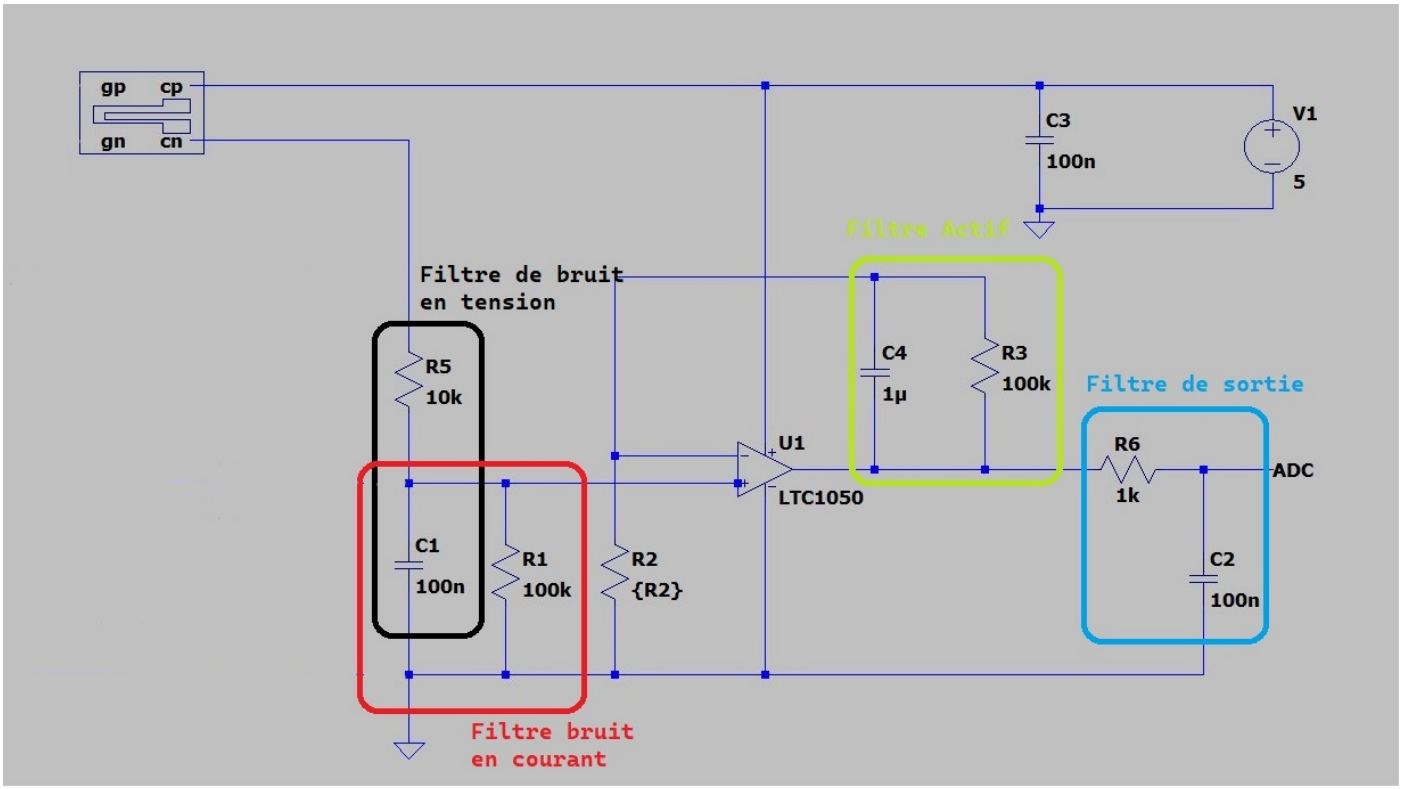


Figure 4: transimpedance amplifier

Component	Unit	Value	Name
Resistance	kΩ	100	R1,R3
Resistance	kΩ	10	R5
Resistance	kΩ	1	R6
Capacity	nF	100	C1,C2,C3
Capacity	μF	C4	
Digital potentiometer	kΩ	0,125-50	R2(MCP41050)
Operational amplifier	-	-	U1(LTC1050)

Table 1: Components of the signal processing circuit