

Exam Submission

by Aaron Stewart Hillam

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TIME SUBMITTED	14-JAN-2021 05:21PM (UTC+0000)	WORD COUNT	705
SUBMISSION ID	142122207	CHARACTER COUNT	3740



Exam Submission

BEng Electrical & Electronic Engineering
ACDA5006 – Transducers and Signal Conditioning

Prepared by:

Mr Aaron Hillam

P141233

Submitted to:

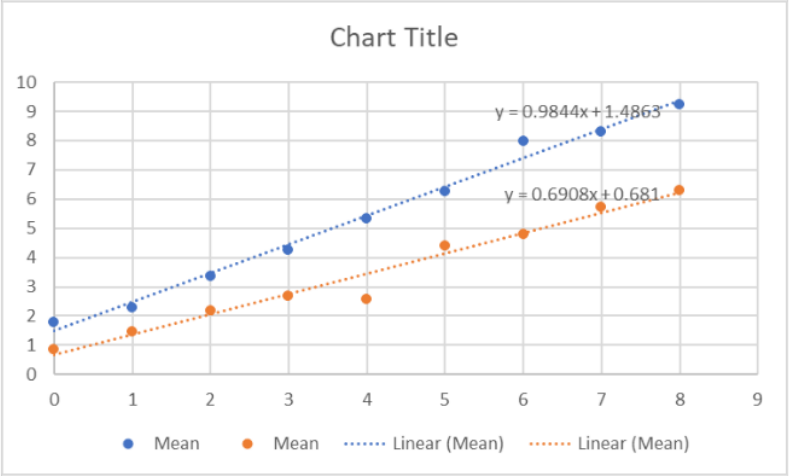
Dr Steve Mosey

School of Computing

14/01/2021

1.

Question	20oC	70oC
1a Sensitivity	0.1231	0.188
1b zero offset	0.1155	0.2059
1c Maximum non-linearity	0.8865	0.59305
1d Humidity Drift Coefficient	0.001298 V/RH%/oC	
1e Humidity Drift Coefficient	0.001808 V/oC	



2.

A) A temperature sensor for a weather station, needs to withstand the smallest debris such as dust or sand, which blow through the wind. In addition, it also needs to be unaffected by heavy rainstorms.

As a result, the sensor that would be required is IP 6 4. The 6 ensures that it is dust tight and the 4 protects against splashing water. Although 3 could be used due to spraying water, instead of 4, but 4 provides extra protection as reassurance.

B) A temperature sensor for checking the coolant temperature of a car engine, must withstand any solid particles within the fuel. As it would be submerged in fuel, potentially for long durations, the sensor must protect against this.



The sensor IP rating code would need to be IP 6 8. This is the only rating which would meet the requirements.

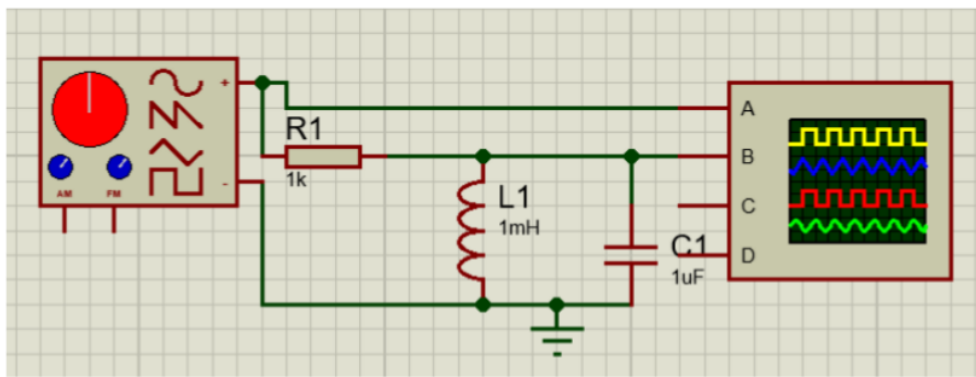


3. The noise affecting transducer signals through a wire, can be reduced through a range of methods, including:

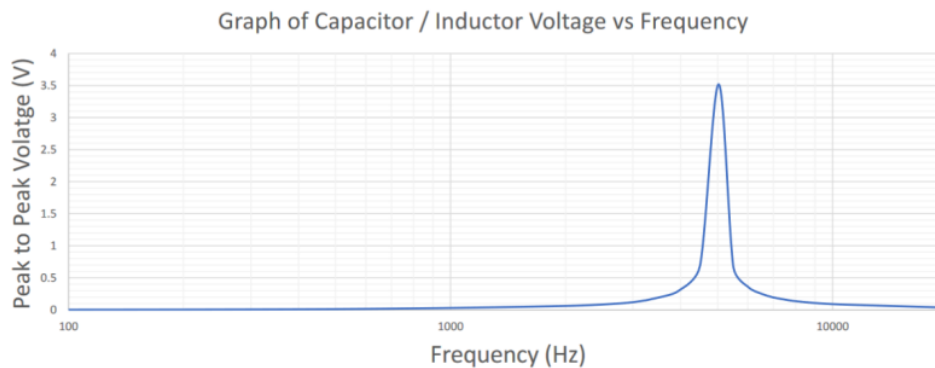
- Using conduits to shield the signal leads.
- Avoid placing wires near sources of interference
- Use twisted pair of wires, including shielded jackets.
- Run wiring through separate shielded conduits.
- Avoid wires crossing over itself / each other.
- Minimise the amount of wiring required.
- Apply good earth practice

A range of bandpass filters can be used to reduce the noise/frequencies from unwanted sources. The RLC circuit below, depicts a simple bandpass filter, it can be used to isolate specific frequency/interference ranges.

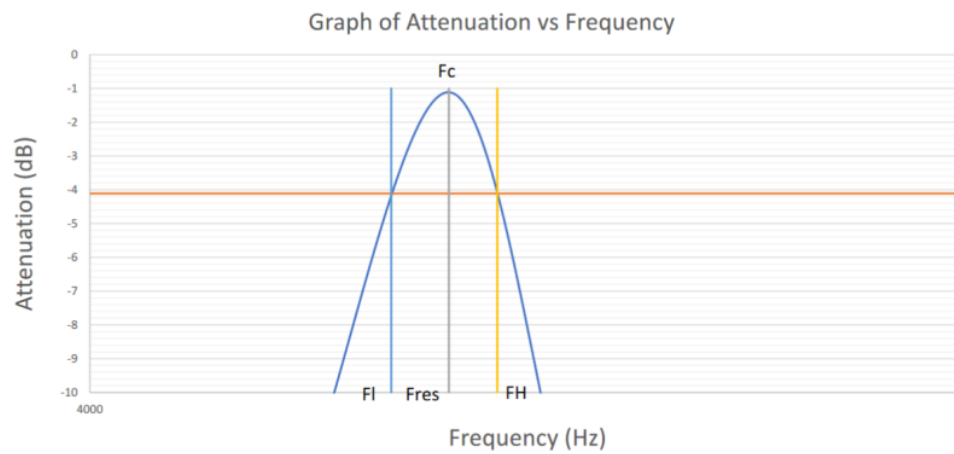
4



These wanted and unwanted signals can be identified, analysed and focused on specific frequencies, as shown in the image below.

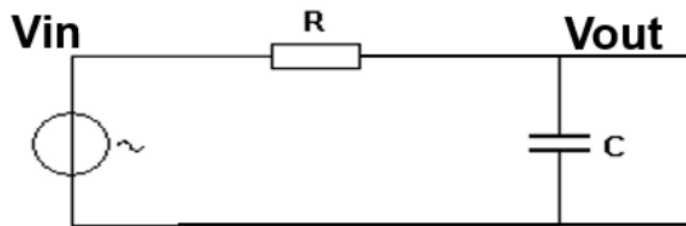


The wanted signal and acceptable range can then be identified and isolated, by applying the bandpass filter.



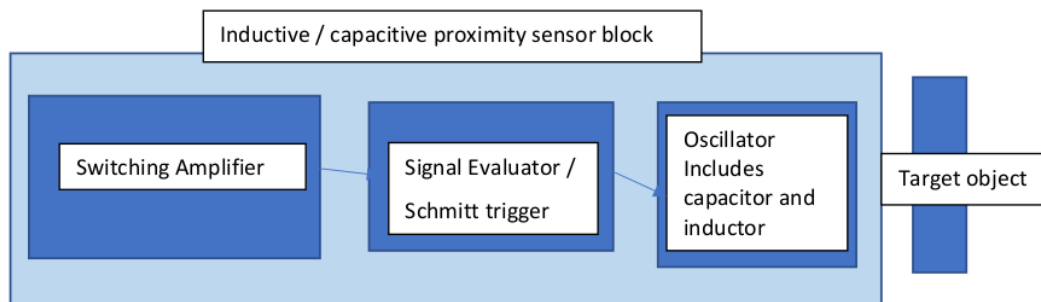
Any specific frequencies detected, may require the use of a band stop filter, which will remove the unwanted / interfering signal range.

In addition, low pass filters or high pass filters can be used, similarly using an RC circuit as shown the image below. This functions by allowing only low frequencies to be detectable by preventing high frequencies from being detected.



4. The inductive sensor, uses an alternate inductive field to detect ferrous materials/objects through an oscillator. Due to the detected material / object it causes the oscillator to dampen, upon reaching a desired threshold, to causes a signal of a change in state. The inductive sensor would be ideal for detected internal functions of an automated machine. This could include the rate of revolutions a conveyor belt roller turns; this detection will help calculate how far an object on the belt has moved. Allowing a PLC to stop and start at various stages.

The capacitive sensor uses an electrical field, this allows it to detect conductive or other non-ferrous materials with a different di-electric different materials / objects than air. As a material/ object moves within the sensing proximity, the change in capacitance occurs, causing a signal of change in state. With the factory setting, the capacitive sensor could be used for counting the objects on top of the conveyor belt and act as a error detection if the item moves beyond the desired location.



Although the block diagram is similar for both inductive and capacitive, the differences include: The electrode used for the sensor. In addition the capacitive sensor also has a voltage regulator.

5. Calibration is the process of confirming and the ensuring that an instrument is reliable and will produce a reading within the given tolerances whilst operating within the required environment. The process of calibration includes:

- checking the instrument against a known and proven measurement, this will show how far the instrument has drifted.
- Using a calibration tool, which resets the instrument to the factory settings and makes adjustments, as needed.

The need of calibration is due to unexpected or uncontrollable circumstances, which cause the instrument to zero shift. Thus, producing false/inaccurate readings. The requirement for calibration can be reduced by operating within the specified conditions.



Exam Submission

GRADEMARK REPORT

FINAL GRADE

45/100

GENERAL COMMENTS

Instructor

Q1a) 0 Marks

Q1b) 0 Marks

Q1c) 0 Marks

Q1d) 0 Marks

Q1e) 0 Marks

Q2)1 Mark

Q3)14 Marks

Q4) 18 Marks

Q5) 12 Marks

Total 45 Marks

PAGE 1

PAGE 2



Comment 1

Q1

a) incorrect 0 Marks

b) incorrect 0 Marks

c) incorrect 0 Marks

d) incorrect 0 Marks

e) incorrect 0 Marks

All answers missing workings.

a) b) and c) missing units.

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Comment 2

why would the sensor be submerged in fuel if it were measuring coolant temperature?



Comment 3

Q2) you have only discussed the environmental characteristics of the sensors. What about measurement range, precision, sensitivity, linearity etc.?

1 Mark

PAGE 4



Comment 4

Q3) 14 Marks

Band pass filters are only effective if the wanted signal is AC, and its frequency does not change.

A more detailed description of twisted pair cables along with a circuit diagram of a difference amplifier subtracting the signals from each other

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PAGE 6



Comment 5

Q4) Good description and examples

18 Marks

PAGE 7



Comment 6

...and other changes in the instrument too. Gain for example.



Comment 7

Q5)

Good explanation although more detail would have improved this.

12 Marks