Voltage Regulators

**Linear Regulator**

-Linear, kind of like a resistor that changes based on the input voltage such that output voltage is always 5V

-Generates a lot of power (because there must be a voltage drop across it)

-Advantage is that there is LOW NOISE and cheap and simple.

**Switch Mode Regulator**

Sucks juice from 9V causing surges in current draw, then pumping that into a big capacitor which then adjusts the switching to supply the voltage level we want (5V)

Will only draw as much current from 9v as much as needed to supply current out.

Iin at 9V will be less that Iout at 5V such that the Pin is ~= Pout.

85-95% efficient.

-But the big jerky current draws result in lots of noise

-Cost is a little more due to complexity and big capacitors.

Note that we must show the ripples in the voltage to justify our choice.

Checkout <https://www.electronics-tutorials.ws/opamp/>

We will need to use an opamp with a gain and and offset.

**Opamp Types**

**Rail to Rail Opamps**

- and + voltage levels can come very close to the rail voltages (the stuff powering the opamp)

Flexibility to go quite high/low with out inputs

-More Expensive

**Normal Opamps**

Does not give us ability to go so close to the rails. (Usually 1V-2V of space)

Cheaper.

Because of Design Requirements

May have to introduce a ‘virtual ground’

We make 5V -> 2.5V and the 0V go to -2.5V. We design for the +2.5 -2.5. We didn’t physically change anything, it’s all in the mind.

**Limitations of common mode voltage**

[(Vin+ - V-) + (Vin – V­­-)]/2

If we choose the voltage ground level, we cannot go above the common node voltage of the opamp. (Also show this theory in our report)

[Ask question about this]

**Sensor**

Has a full range which isn’t ideal but is quite cheap.

**Arudino**

Our onboard ADC will go from 5V to 0V

The challenge is taking the range we have, and amplify it to range must be a MINIMUM of 3.2V

Range of 42C to 34C must have a range of AT LEAST 3.2V in the design.

Delta 8C must have a delta of 3.2V with the given input of xmV

1. How do I remove the 80mV (whatever) offset?

2. What amplification level is needed?

LECTURE 2

Choose Linear Regulator

Virtual ground

I have an offset of 640mV and delta(V) of 15mV / C