

PHYS 605 Homework 7 Project Proposal

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1 Project - Distortion Pedal

Our group has decided to build a distortion pedal for our project. We encountered unwanted and uncontrolled distortion in Lab 5 when we made our common emitter amplifier (CEA) and we thought it would be interesting to experiment and see what distortion different diodes and circuits would output. We want to do this because we encountered really interesting distortion effects in Lab 5 and would like to more deeply understand how diodes and amplifiers can affect distortion and gain a better intuitive understanding of how they work.

2 Detailed Plan

We have two ideas for how to build this distortion pedal. The first idea is to create a transistor amplifier (Figure 1) and have the diodes in the design of the amplifier itself. Since we are already familiar with the CEA, we would be more comfortable with this as well as experimenting with it. This distortion pedal would be very similar to the CEA, but would have to have most of the component values changed. We will be trying to use two different transistors, the one that we used for the CEA (the 2N3904) and the BC337-25, one that we found on an [online guide](#) for making a distortion pedal¹. With this circuit our input would be a variety of waves at different amplitudes and frequencies, and

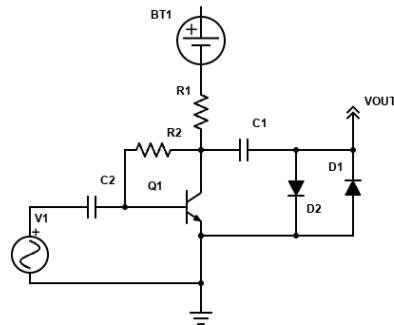


Figure 1: Transistor Amp Distortion Pedal

*Each reference used in this report is a hyperlink.

¹This transistor can be found in the Bill of Materials(Section 3)

we would analyze how the output is distorted based on wave type, amplitude, frequency, and components in the circuit such as the capacitors and diodes. The second idea is to use an op-amp instead of building a transistor amp and have the diodes in the feedback loop of the op-amp for “soft clipping” or diodes between the op-amp and the output for “hard clipping”.

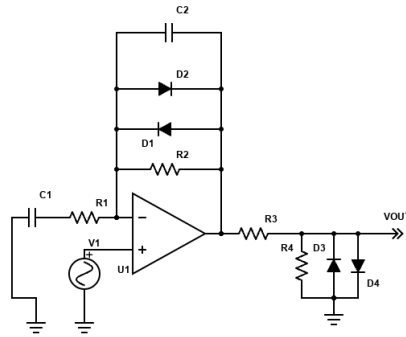


Figure 2: Op-Amp Distortion Pedal Circuit

amplifier. We run a variety of waves with different parameters through the circuit and analyze the output and its distortion with different combinations of components. This will give us a better intuition for how diodes and amplifiers affect an input voltage through experiment and experience, allowing us to more easily understand circuits. Since we couldn’t find any specifications for how our specific circuit will work, it isn’t necessarily feasible to calibrate the pedal as a whole³ but we can characterize it by analyzing the output and determining how changing the values of components and the types of components affects the output. Building an understanding from experience and experiment is how we will be able to characterize our circuit.

We would use the same diodes as the transistor amplifier circuit, but would be able to test both the op-amp we used in Lab 5, the MCP6002, or the NJM14558, an op-amp chip used in a different [online guide](#). An interesting thing to test would be trying both hard and soft clipping at the same time (Figure 2) and seeing what results we’d get². The second idea is a bit more reliant on the op-amp but would likely be more fruitful in its results. The process for this circuit would be the same as the transistor

Nice guide!

3 Bill of Materials

Parts Not in Library			
Component	Part Number	Data Sheet Link	Estimated Cost
Transistor	BC337-25	BC337-25 Datasheet	\$0.14
Op-Amp	NJM14558	NJM14558 Datasheet	\$1.10
Diodes	BAT41	BAT41 Datasheet	\$0.39

Table 1: Bill of Materials for Parts Not in UNH Parts Library

²Another interesting idea would be to try asymmetric vs symmetric clipping by changing the number and types of diodes we use in the feedback loop.

³We can(and will), however, calibrate individual components.

Parts not in the UNH Parts Library will be requested for purchase by the University.

Parts in Library	
Component	Part Number
Resistors	Variety ⁴
Capacitors	Variety
Transistor	2N3904
Op Amp	MCP6002
Diodes	1N4148 & Red LED

Table 2: Bill of Materials for Parts in UNH Parts Library

Nice project and your write-up is pretty good. Good that you provide the references for the source of your circuits. I am a bit questioning the transistor amp source, which comes across as not fully reliable. You may want to think a bit about that design.

Some comments:

- You request some very specific parts (BC377 and special OpAmp). It would be good if you could say why you need these and not the generic parts that are available (2N3904 and MCP6002 or LM471).
- I think you really need to plan on sending some guitar output through your circuit. Or at least some recorded music.

⁴Values will vary with experimentation.