ECE393 – Quiz 1

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Goal

Make a DTMF decoder in LTSpice. It should take a .wav file as an input, and you should be able to be able to clearly differentiate between different tones based on some visible (or audible) output.

See Figures 1 and 2, on the following pages, for the schematic and the output plots.

Implementation details

- The circuit is 8 bandpass filters in parallel, one for each of the DTMF frequencies.
- Each bandpass filter is a LC tank (I tried using RC filters, but this was much more unreliable, and LC tanks work pretty well because they resonate at a single tone, which is what we need here). For simplicity, I set all of the capacitor values to the same value (1 mF), and calculated the required inductor values using the formula

$$2\pi f = \frac{1}{\sqrt{LC}}$$

  where f is the set of DTMF tones (i.e., 697Hz, 770Hz, 852Hz, 941Hz for the low group, and 1209Hz, 1336Hz, 1477Hz, and 1633Hz for the high group).
- To read the DTMF values, I overlaid the low group values (LG1-4) on one plot plane, and the high group values (HG1-4) on another plane and read the DTMF values by looking at which LC tank resonated for each tone.

In the case of the .wav file whose plot is shown in Figure 2, the determined DTMF sequence is:

Low group tone	High group tone	Decoded symbol
4	1	*
4	3	#
3	2	8
2	1	4
1	3	3

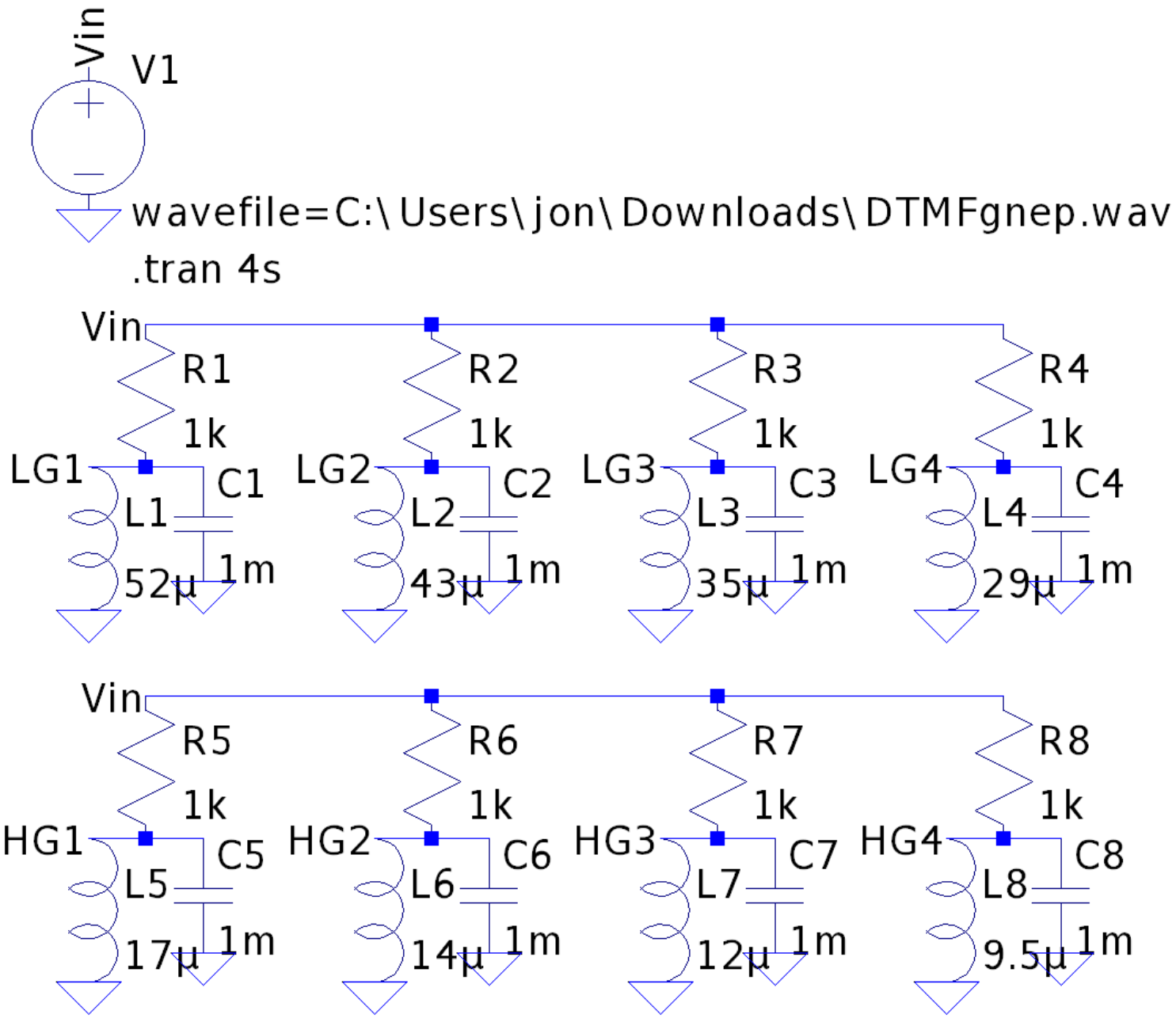

Figure 1: Schematic

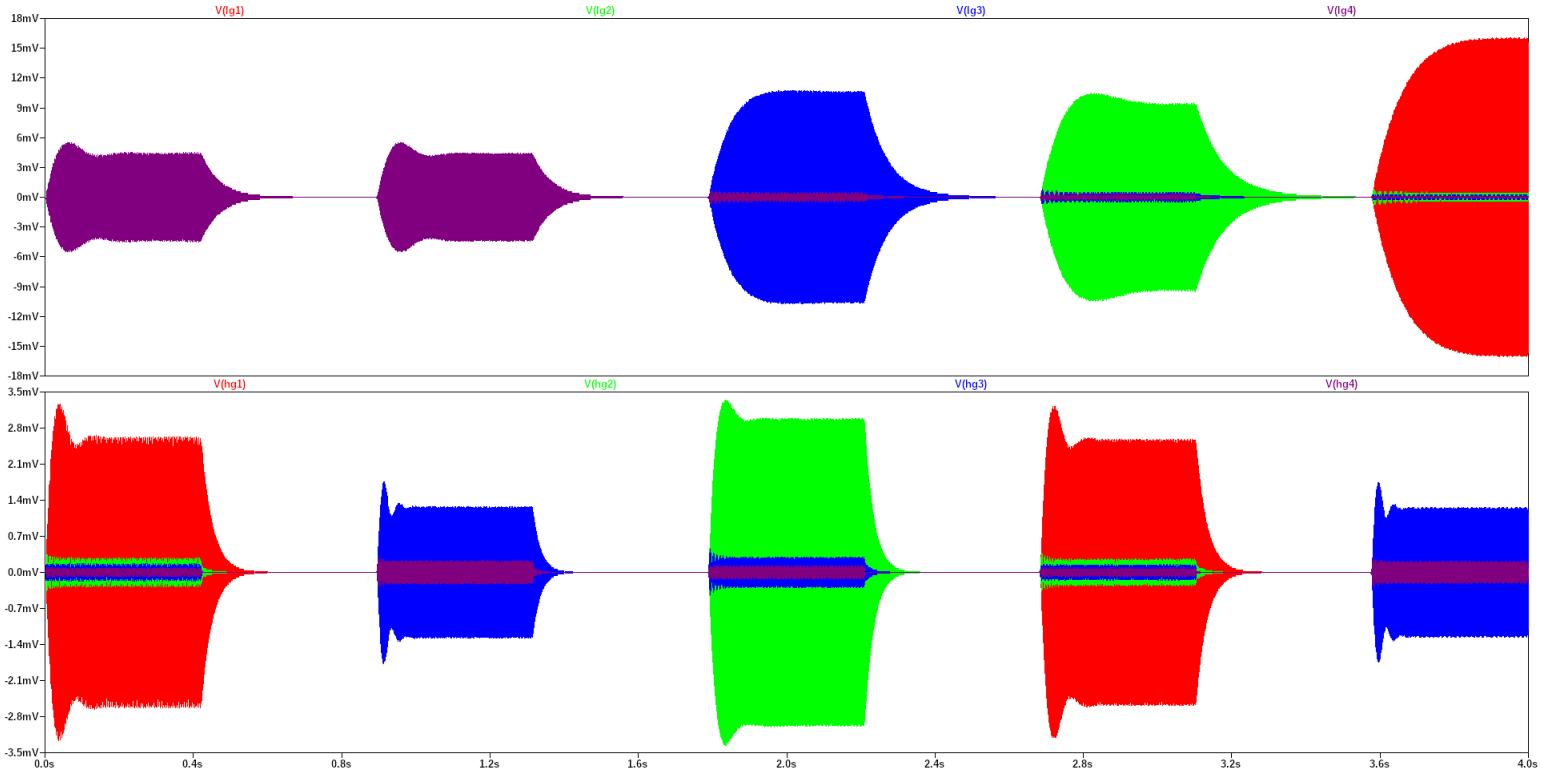

Figure 2: Top plot shows low-group tones; bottom plot shows high-group tones. In order from lowest to highest frequency: red, green, blue, purple. Thus the low group tones are [4, 4, 3, 2, 1], and the high group tones are [1, 3, 2, 1, 3].