EE 230
Experiment 8 Supplement
Spring 2010

Nonlinear Circuit Applications – Waveform and Nonlinear Function Generation Comparator Arrays

This laboratory experiment is for extra credit only. Extra credit will be given based upon either partial or total completion of this experiment. This is intentionally less structured than the other laboratory experiments in this course and may require some information that has not been discussed in the lecture or laboratory part of this course.

Components:

741 Operational Amplifier
1N4006 Diodes
Assorted resistors

Objectives: The objective of this experiment is to develop increased experience with nonlinear circuits and to provide an exposure to distortion and spectral characterization.

Part 1 Sinusoidal Waveform Generation using Nonlinear Waveform Generators

Design a sinusoidal waveform generator that will convert a triangle waveform into a sinusoidal waveform using a nonlinear diode function generator. With this approach, a piecewise linear approximation of a sinusoidal waveform can be obtained. You may pick the number of linear segments that you use but as few as 5 segments will probably give reasonably good results. Design the circuit to operate with a 16V p-p triangle waveform. Focus the design on frequencies between 100Hz and 1KHz. Demonstrate experimentally how wide of a frequency adjustment range can be made with the triangular input while still maintaining a sinusoidal output. You may either generate the triangle waveform yourself or use the signal generator to provide the triangular waveform.

Part 2 Measurement of Spectral Characteristics of Periodic Waveforms

Measure the spectral response and the total harmonic distortion of the waveform you generate in Part 1 and compare with that of the Wein-Bridge Oscillator you designed in the last experiment. Specifically, obtain the magnitude of the fundamental and the first 4 harmonics. The oscilloscope on the lab bench can obtain the spectral components of a waveform.

Part 3 Instantaneous Power Measurement

The instantaneous power in a waveform f(t) is defined to be a constant multiplied by $f^2(t)$. Design a circuit that provides an output voltage that represents the instantaneous power of an input waveform. Test your circuit with a square wave input, a sinusoidal

input, and a triangular input. Compare the results you obtain with what theoretical results.