

Project : A resonant driver for a piezoelectric transformer
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Abstract

The main objective of this project is to build a resonant driver for a piezoelectric transformer (PT) which works in a wide frequency range. The purpose of this circuit is to check and measure different PT properties. The inputs of the system are a DC voltage and a squarewave signal, the output is a 150[V_{rms}] ac signal with a frequency equal to the reference input signal. The frequency range is set to be 48kHz -110kHz.

The main problem in driving PT is the input impedance seen from the driver, which has a capacitance behavior, consequently a conventional driver will not function properly due to the phase shift of the current.

To compensate the phase shift, the system includes a resonant regulator with a variable inductor, which changes its induction as a function of the current in a Buck Transformer. The input resistance seen from the driver at the resonant frequency is pure ohmic, hence the phase shift is zero. In this project we built the first implement, such a circuit can be integrate and sent to mass production as a complete frequency tracking system.

There are two main control loops in the circuit, the first is a zero detect (ZD) which insures that the resonant transformer works at the resonant frequency. The second contains two more control loops, the external loop includes a phase detector (PD), a low pass filter, a Pulse Wide Modulator (PWM) and a Buck regulator. The internal loop contains a current transformer and a second low pass filter which limits the current in the bias inductor.

We use UC3872 a "Texas Instrument" chip which contains both the ZD and the PWM. For the PD we use CD4046A a "Philips" chip for PLL applications. Power transistors were use to reduce the power consumption. The maximum current in the bias inductor is 1A which is fit for the frequency range written above.

