

Public Abstract

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Graduation Term:SP 2016

Department:Electrical Engineering

Degree:PhD

Title:Study of High Voltage Charge Pumping with a Resonant Piezoelectric Device

A lithium niobate piezoelectric transformer (PT) was studied as a high voltage driver for a compact x-ray source. PTs are devices that are commonly found in consumer electronics and typically provide between 100 and 300 volts of electric potential. However, by operating the PT under vacuum and driving it close to its natural harmonic resonant frequency, much higher voltages can be achieved. This work studied the behavior of PTs operated between 20 and 30 thousand volts, which enabled the production of x-ray radiation for radiographic imaging applications. A well-calibrated electron gun was used to deliver known amounts of current to the output of the PT. A laser-optical diagnostic was used to measure the internal electrical and mechanical fields of the PT to determine maximum stress and output voltage. An x-ray sensor was used to measure the radiation produced by the PT x-ray source. The findings of this work provided important fundamental information for future PT-based handheld x-ray technology.