

Master 2019

Ms. Aishwarya Ramkrishna Bidri

Asymmetric Waveform Generator Driving Capacitive Load to be Used in an Ion Control Device.

ABSTRACT - Masterthesis

The main aim of this thesis encompasses on the electronics development of the mass analyzer of a Mass spectrometer based on Field asymmetric ion mobility spectrometry (FAIMS). This FAIMS technique of ion separation at atmospheric pressure has attracted attention over the recent years. In this technique, the ions are separated on the basis of their differential mobility under the influence of strong electric field. The main motive is hence, to create a high voltage, bi-sinusoidal asymmetric RF field and applying it to the FAIMS electrodes which forms the load structure in this thesis work.

A bi-sinusoidal asymmetric waveform having an amplitude of 180 V p-p or more at a base frequency of 20 MHz and its first harmonic 40 MHz has to be generated using realistic components. The major concept that is being exploited is "resonance". At resonance condition in an electric circuit, the energy is transferred between the magnetic field of an inductor and the electric field of a capacitor that energizes the entire circuit and results in a higher voltage amplitude. The thesis work also considers the real time scenarios with respect to the losses suffered and the complexities that arises in a practical environment with concern to high frequency. Many toroidal transformers are constructed by manually winding coils on various cores of different sizes and materials. Numerous practical considerations originate in this manual construction that has to be included in the simulations. With inclusion of several simulations and practical experiments, a final working prototype of an asymmetric waveform generator has been presented and verified.