

# A Study of Sensitivity of Nonlinear Oscillations of a CLD Series Circuit to Parametrization of Tunnel Diode

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Tunnel diode, also known as, Esaki diode [1] is a peculiar nonlinear electronic element possessing negative ohmic resistance. We consider a circuit composed of three elements: a charged capacitor,  $C$ , a self-inductor,  $L$ , and a tunnel diode,  $D$ . All three in series. We parametrize the I-V characteristics of the diode and derive the circuit equation; this is a nonlinear differential equation. Applying a Computer Algebra System (CAS) specifically Mathematica [2] we solve the circuit equation numerically conducive to a diode dependent parametric solution. In this note we investigate the sensitivity of the nonlinear oscillations as a function of diode's parameters. Particularly we establish the fact that for a set of parameters the tunnel diode becomes an ohmic resistor and the circuit equation simplifies to classic RCL-series circuit with linearly damped oscillations. Mathematica simulation assists visualizing the transition.

## **Keywords**

Tunnel Diode, Electrical Nonlinear Oscillations, Computer Algebra System, Mathematica

## **References**

- [1] LEO ESAKI DIODE. [HTTPS://EN.WIKIPEDIA.ORG/WIKI/TUNNEL\\_DIODE](https://en.wikipedia.org/wiki/Tunnel_diode).
- [2] MATHEMATICA<sup>TM</sup> (2017) IS SYMBOLIC COMPUTATION SOFTWARE, V11.2, WOLFRAM RESEARCH INC.