

# Circuit Simulation Project

<https://esim.fossee.in/circuit-simulation-project>

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**Project Guide : Dr.R.Maheswari**

**Title of the Project : LUO Converter**

**Theory/Description :**

In this Project, Output Waveforms of LUO converter in esim is analysed. Luo-Converters are a series of new DC-DC step-up (boost) power conversion circuits. These converters perform positive to positive DC-DC voltage increasing conversion. The developed circuits (self-lift, re-lift and multiple-lift circuits) offer higher step-up DC-DC conversion. Luo-Converters possess interesting features such as simple circuit structure, high efficiency and near-zero output voltage and current ripples. The luo converter has one inductor, one power switch and two diodes. And also has filter for reduce the harmonics of the output voltage. When power switch is turned on inductor get energised and the voltage is goes to output capacitor through diodes. The capacitor is is discharge the voltage across the load.

## Circuit Diagram of LUO converter:

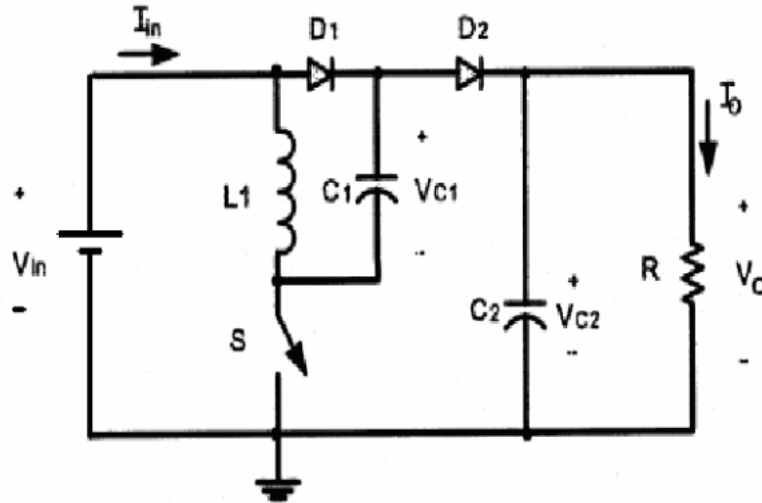


Figure 1 : Circuit Diagram of LUO converter

$L1$ ,  $L2$  and capacitors  $C1$ ,  $C2$ ,  $R$  is the load resistance. To analyse the operation of the Luo converter, the circuit can be divided into two modes. When the switch is ON, the inductor  $L1$  is charged by the supply voltage  $E$ . At the same time, the inductor  $L2$  absorbs the energy from source and the capacitor  $C1$ . The load is supplied by the capacitor  $C2$ . The equivalent circuit of Luo converter in mode 1 operation is shown in fig 2. During switch is in OFF state, and hence, the current is drawn from the source becomes zero, as shown in fig 3. Current  $i_{L1}$  flows through the freewheeling diode to charge the capacitor  $C1$ . Current  $i_{L2}$  flows through  $C2 - R$  circuit and the freewheeling diode  $D$  to keep itself continuous. If adding additional filter components like inductor and capacitor to reduce the harmonic levels of the output voltage.

## Modes of Operation:

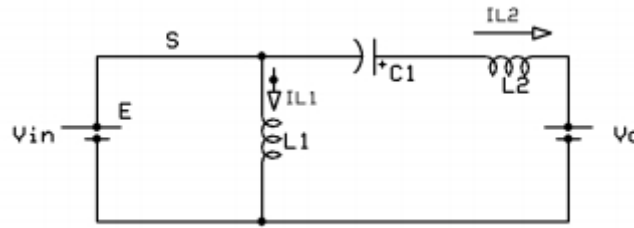


Figure 2 : Switch On Condition

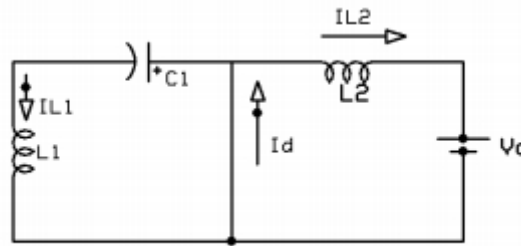


Figure 3 : Switch Off Condition

**Mode 1:** when the switch is ON, the inductor L1 is charged by the supply voltage E. At the same time, the inductor L2 absorbs the energy from source and the capacitor C1. The load is supplied by the capacitor C2. The equivalent circuit of Luo converter in mode 1 operation is shown in fig 2.

**Mode 2:** switch is in OFF state, and hence, the current is drawn from the source becomes zero, as shown in fig 3. Current  $i_{L1}$  flows through the freewheeling diode to charge the capacitor C1. Current  $i_{L2}$  flows through C2 –R circuit and the freewheeling diode D to keep itself continuous.

## Model Graph:

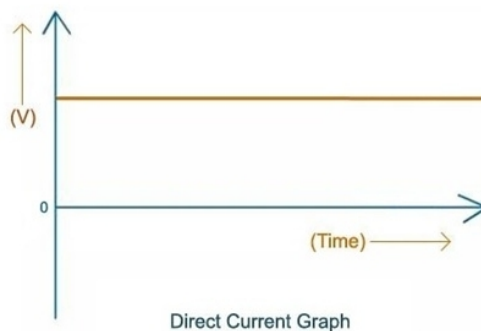


Figure 4 : Output Waveform of LUO Converter

# Esim Circuit Diagram :

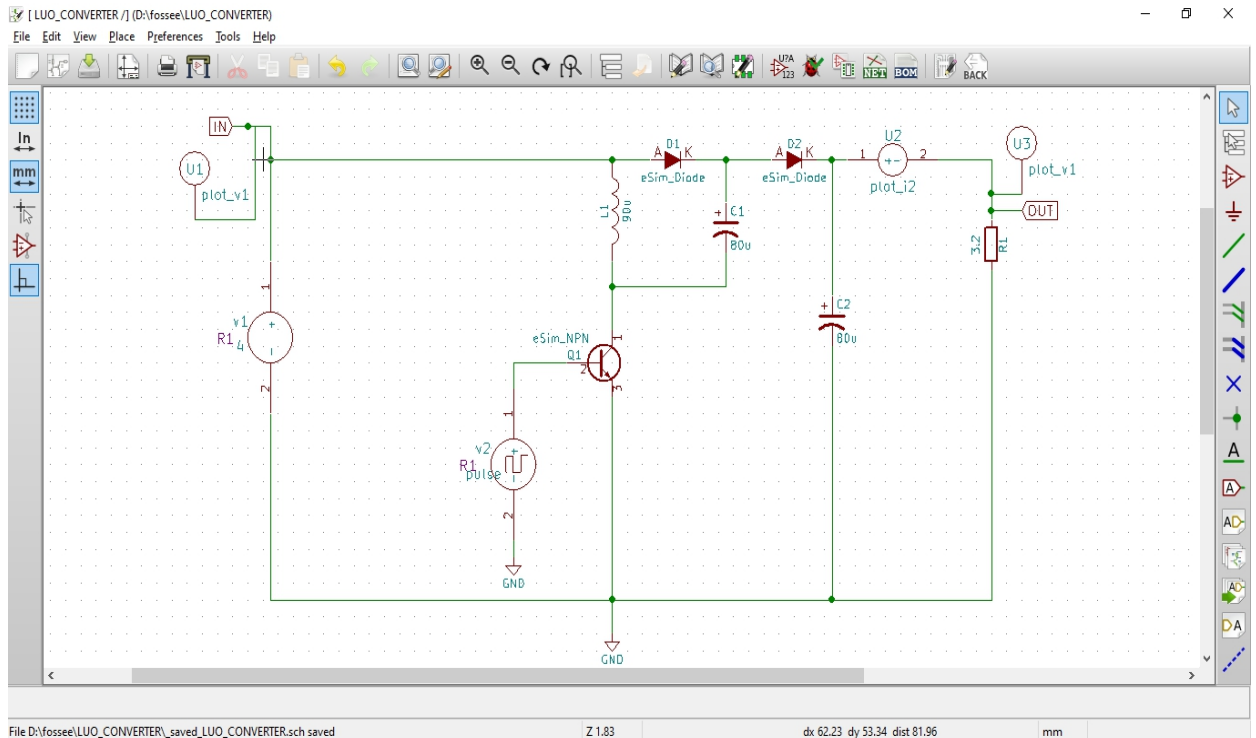


Figure 5 : Esim Circuit Diagram of LUO converter

# Simulation Results :

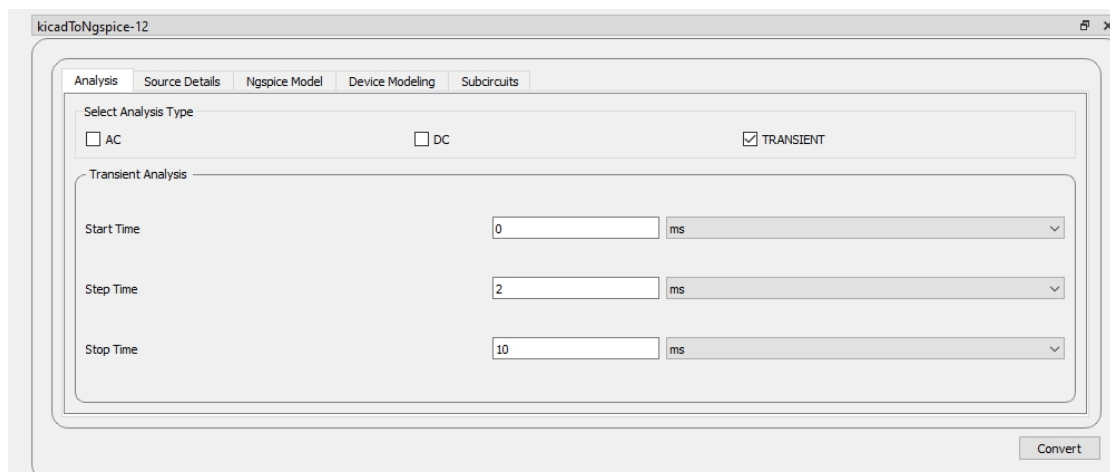


Figure 6 : Kicad to Ngspice

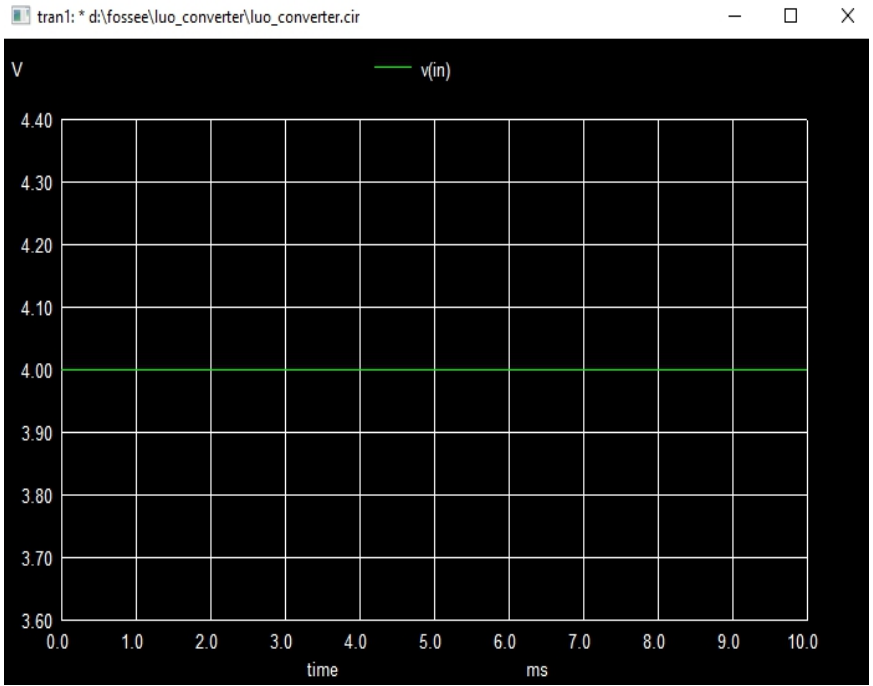


Figure 7 : Vin Waveform

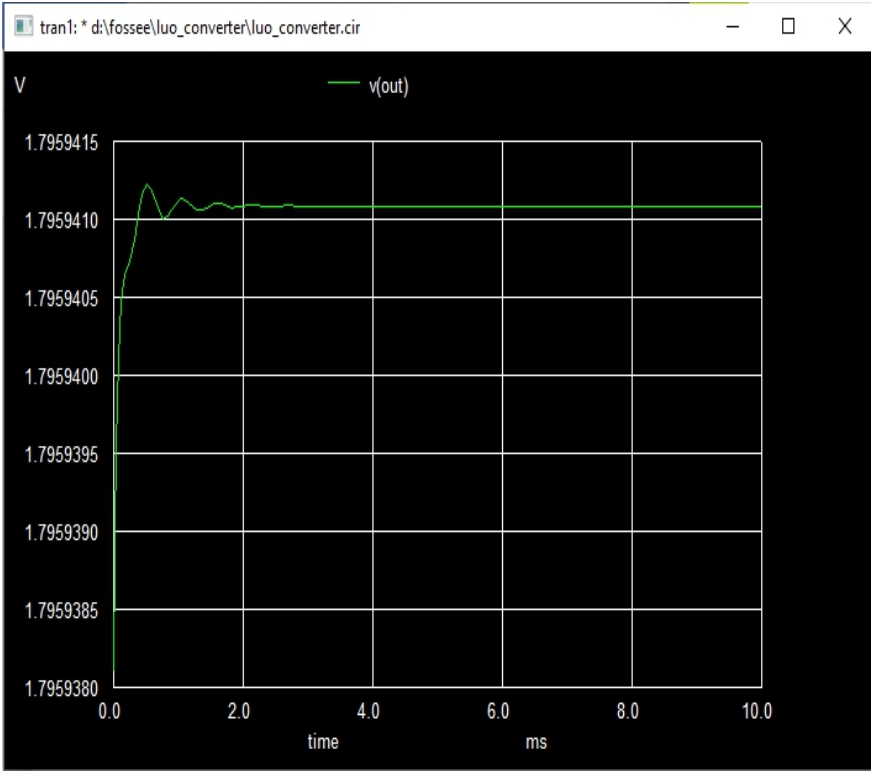


Figure 8 : Vout Waveform

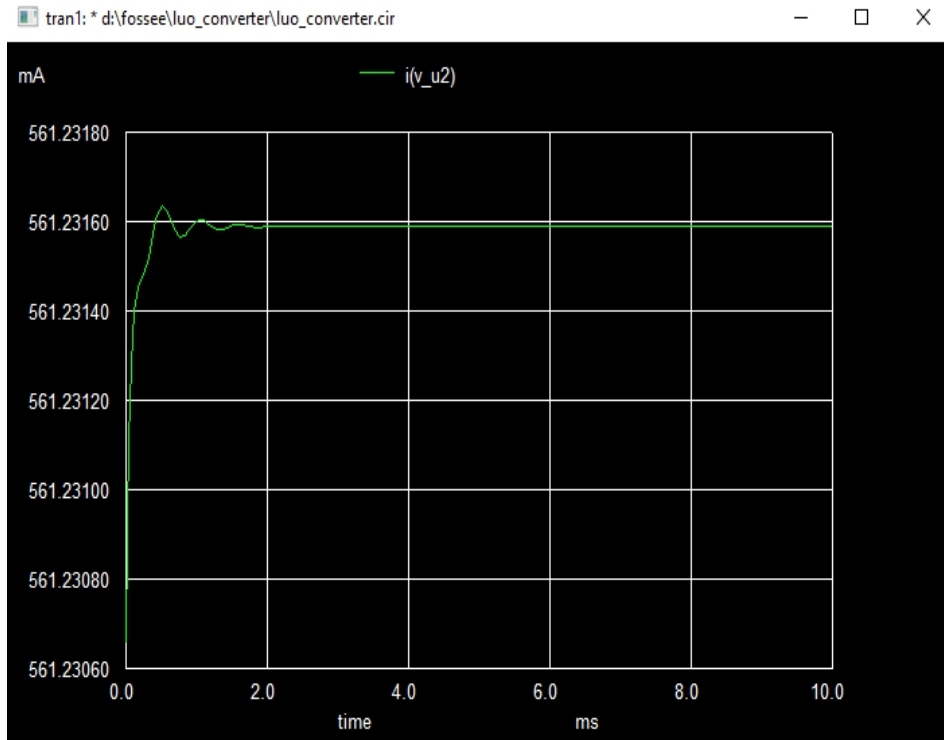


Figure 9 : Current Waveform

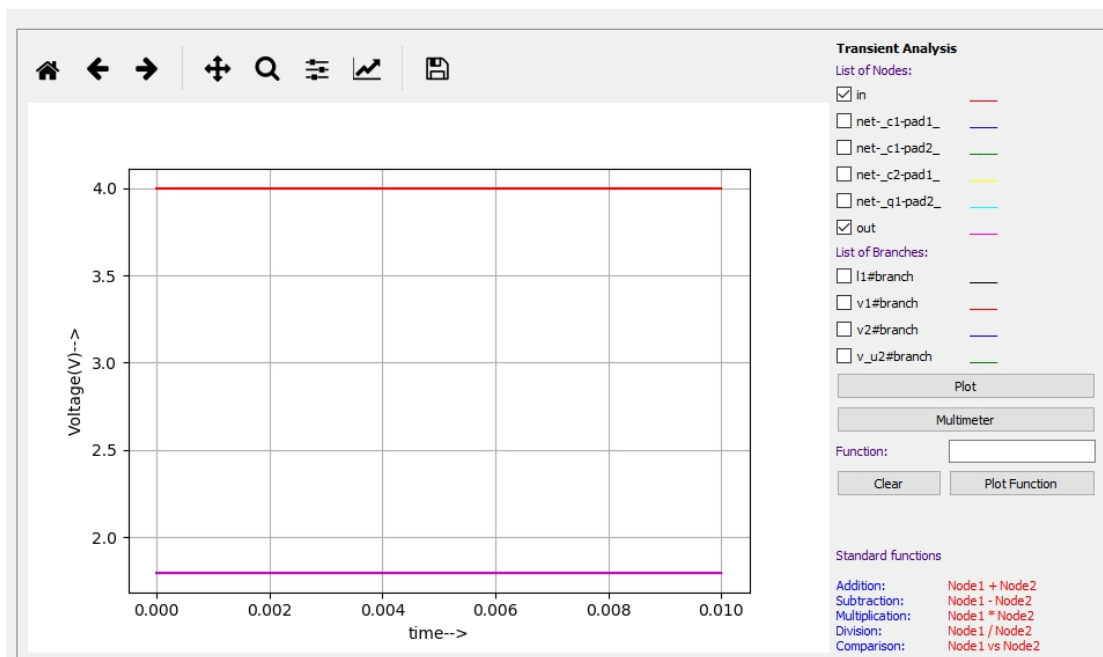


Figure 10 : Python Waveform

## **Conclusion :**

Hence , the analysis of LUO converter in esim is Studied and got the appropriate waveform.

## **References :**

<https://www.pantechsolutions.net/luo-converter>

<https://ijettjournal.org/volume-4/issue-10/IJETT-V4I10P130.pdf>

<https://ieeexplore.ieee.org/document/627511?arnumber=627511>