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Modeling of Current Source Inverter from Voltage Source Inverter Based on Duality Concept

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Abstract—This Paper presents a comparison between the conventional single phase voltage source inverter (VSI) and corresponding current source inverter derived from VSI, based on the duality concept. Different single phase VSI circuits with different combinations of various loads are converted a corresponding CSI by duality principle. The simulations have been done in MATLAB and waveforms captured.

Keywords— Current Source Inverter, Duality, Inverter, Voltage Source Inverter,

I. INTRODUCTION

Voltage source inverters (VSI) are very common and in wide use. The approach used here is to obtain a current source inverter (CSI) from a VSI based on the duality principles.

II. THE DUALITY CONCEPT FOR ELECTRICAL CIRCUITS

The duality concept has been used and tried out for different case by modeling and simulating the following for single phase voltage source inverter circuits, the voltage source circuits are made into a dual current source circuit using the duality concept. The following 5 cases have been considered:

1. A VSI with a resistive load , it's dual is a CSI with a corresponding conductance (resistance).
2. A VSI with a series resistive and indutor load, it's dual is a CSI with a corresponding conductance(resistance) and capictance in parallel.
3. A VSI with a parallel resistive and indutor load, it's dual is a CSI with a corresponding a conductance (resistance) and capictor in series.
4. A VSI with a series resistive and capacitor load, it's dual is a CSI with a corresponding conductance (resistance) and inductor in parallel.
5. A VSI with a parallel resistive and capacitor load, it's dual is a CSI with a corresponding conductance (resistance) and inductor in series.

III. SIMULATION CIRCUITS AND RESULTS

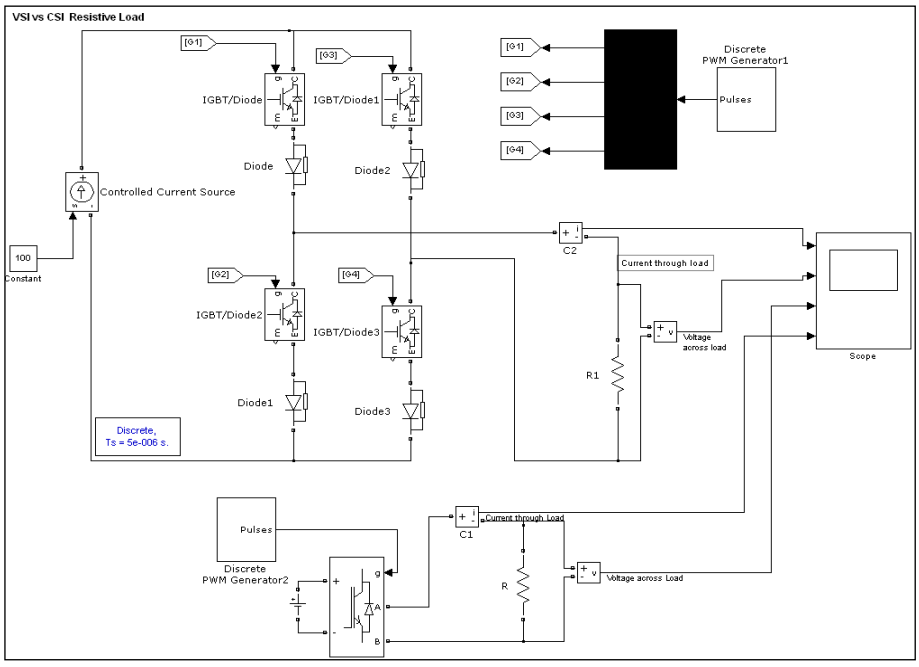

Fig.1 VSI v/s CSI for resistive load

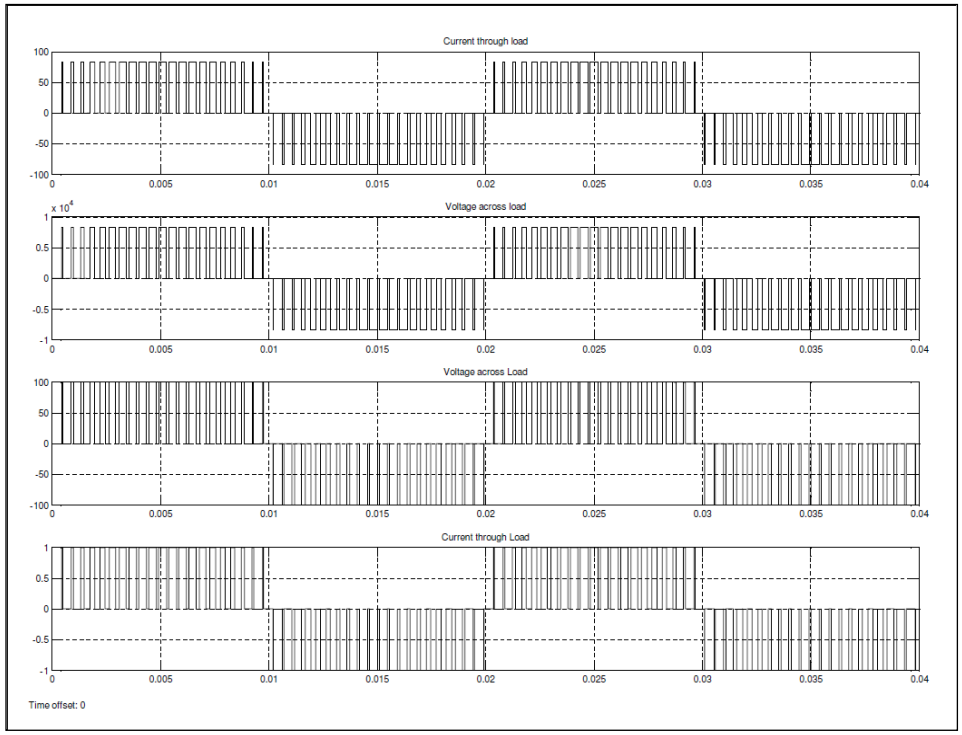

Fig.2 Voltage and Current waveforms for Fig.1

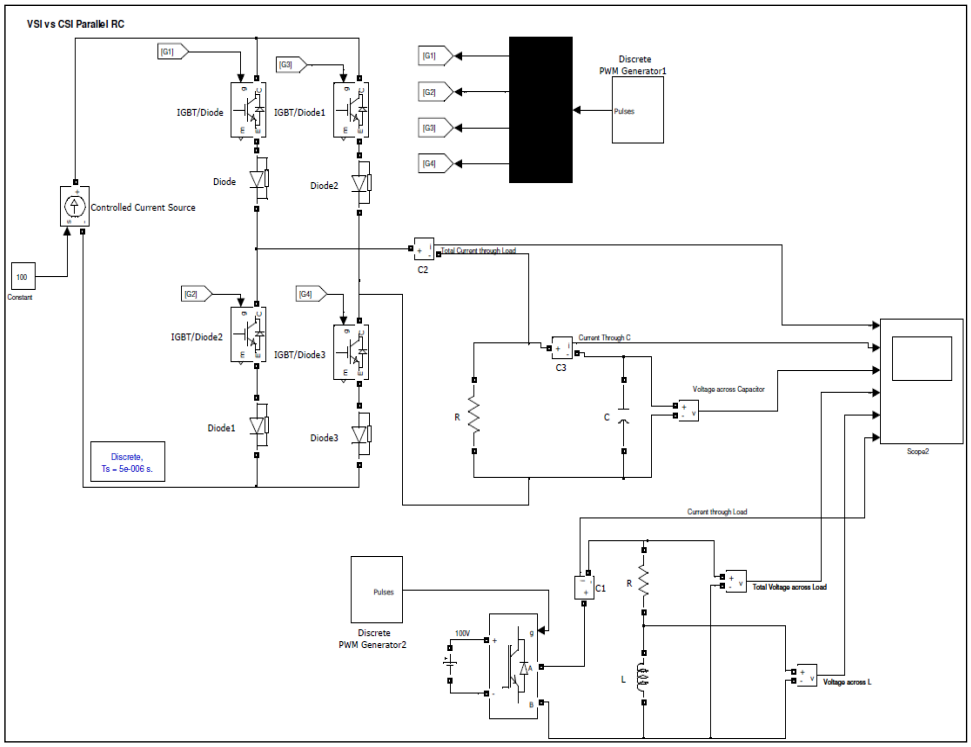

Fig.3 VSI series R-L v/s CSI parallel R-C

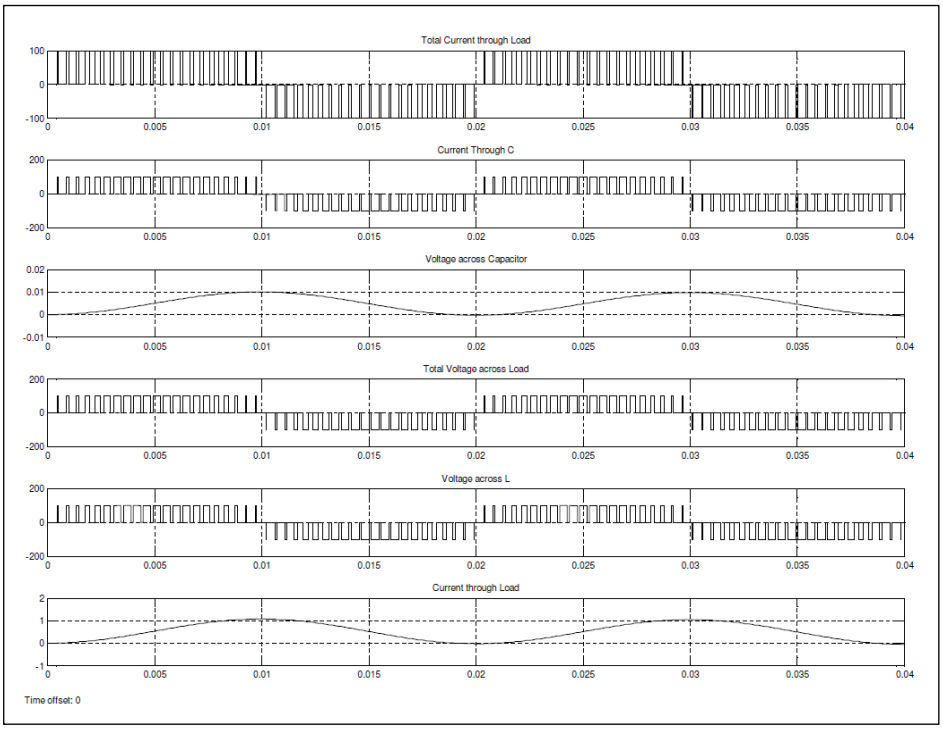

Fig.4 Voltage and Current waveforms for Fig.3

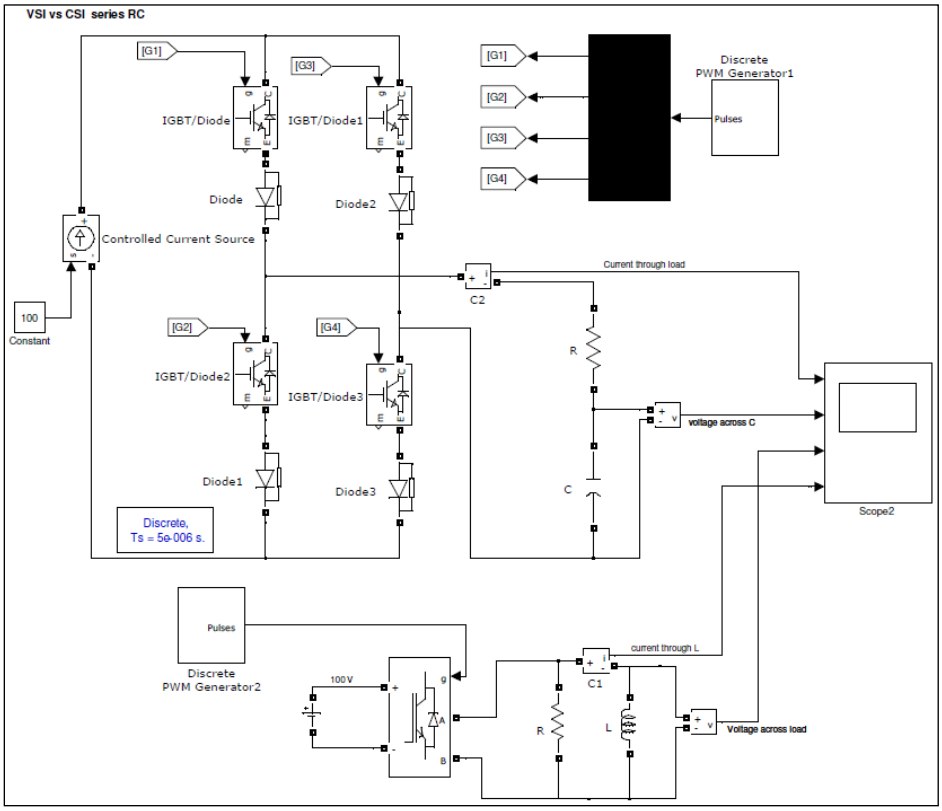

Fig.5 VSI parallel R-L v/s CSI series R-C

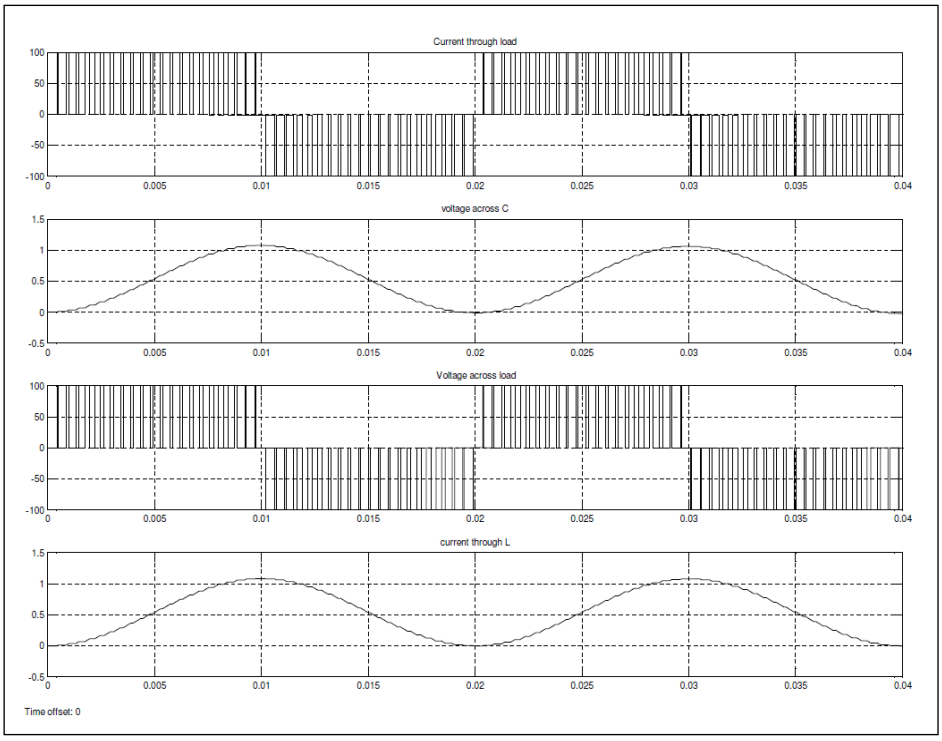

Fig.6 Voltage and Current waveforms for Fig.5

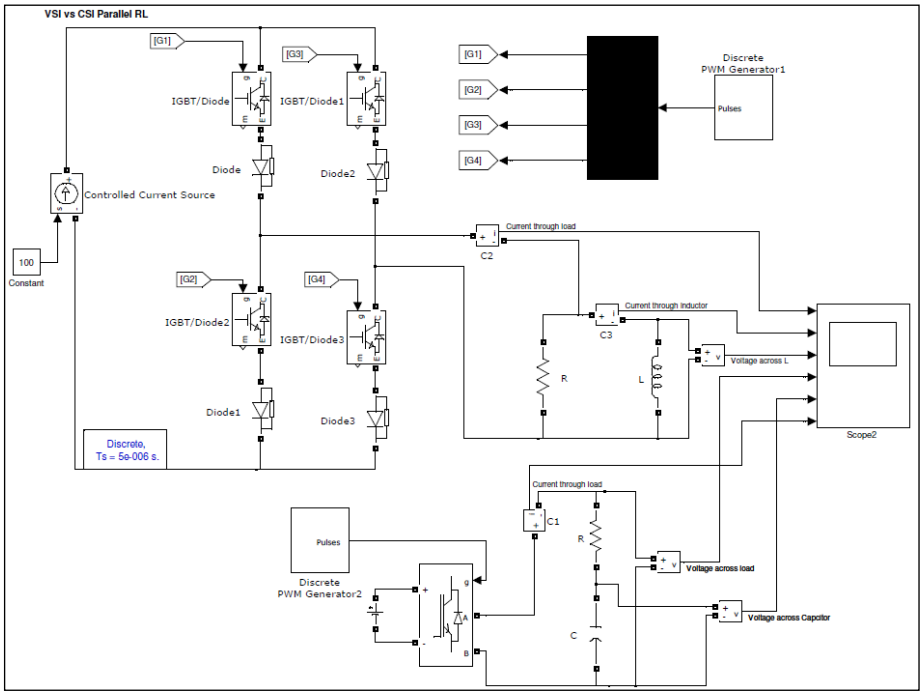

Fig.7 VSI series R-C v/s CSI parallel R-L

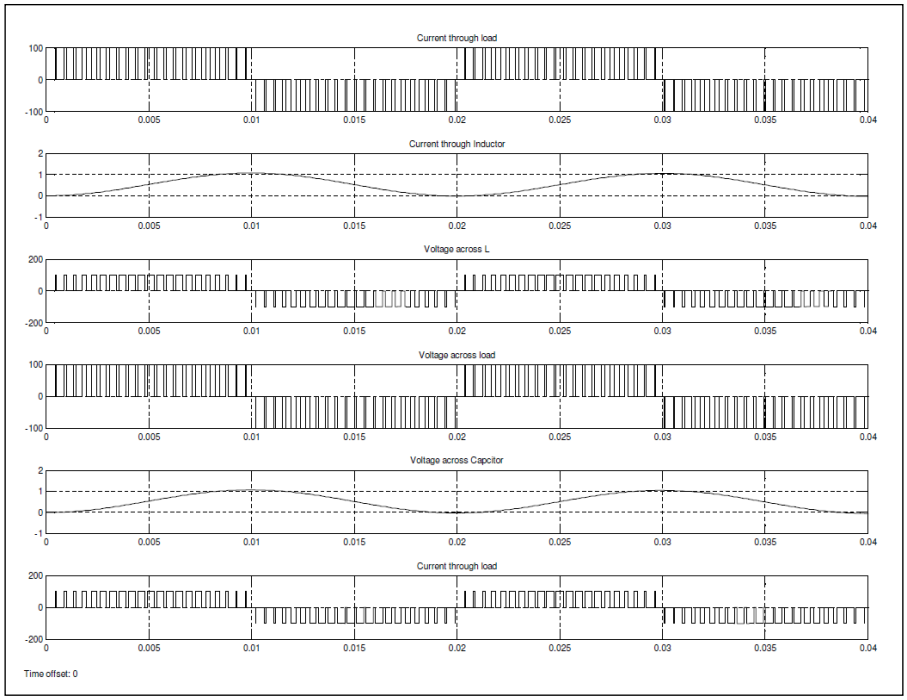

Fig.8 Voltage and Current waveforms for Fig.7

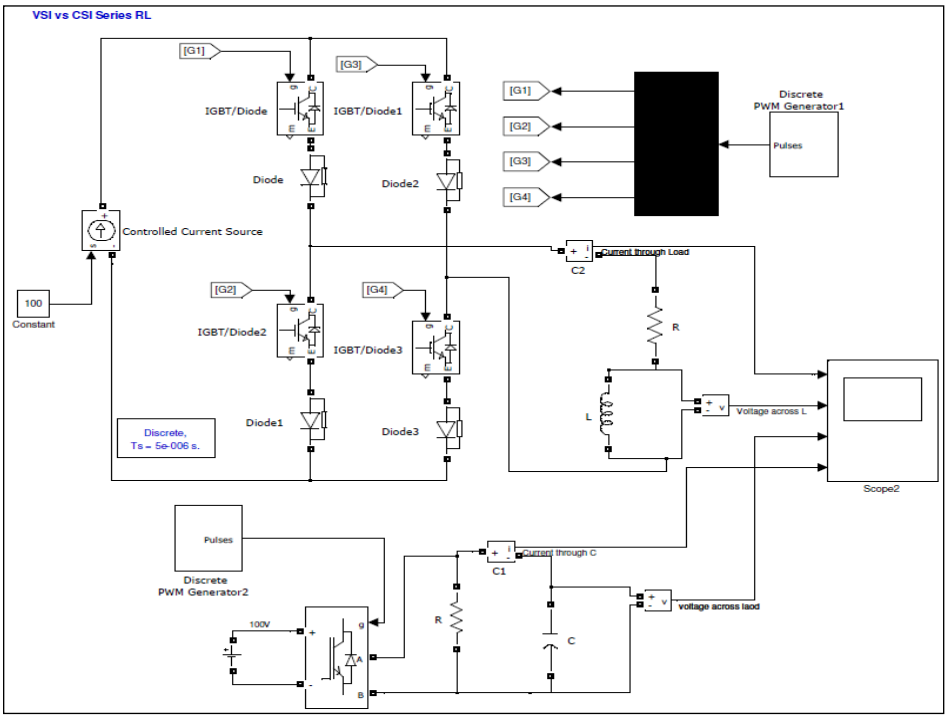

Fig.9 VSI series R-C v/s CSI series R-L

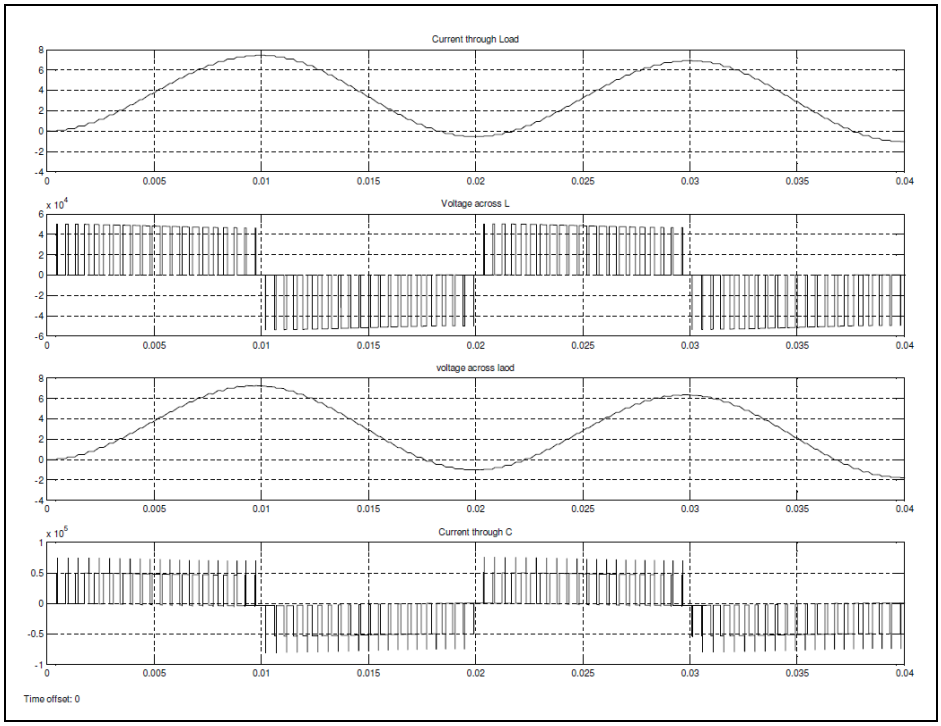

Fig.10 Voltage and Current waveforms for Fig.9

IV. RESULT

It is observed that the current and voltage waveforms are interchanged when a voltage source inverter is made to a current source inverter based on the duality principle. For the different single phase VSI cases we have.
The voltage across the resistive load for VSI is the current through the (conductance) resistive load for the CSI.
The voltage across the inductor load in series for VSI is the current through the capcitor load in parallel for the CSI.
The voltage across the inductor load in parallel for VSI is the current through the capcitor load in series for the CSI.
The voltage across the capacitor load in series for VSI is the current through the inductor load in parallel for the CSI.
The voltage across the capacitor load in parallel for VSI is the current through the inductor load in series for the CSI.

V. CONCLUSION

A current source inverter can be modeled from a voltage source inverter using the duality principle, here the voltage waveforms of the VSI are nothing but the current waveforms of the CSI, the voltage source becomes a current source, the series connection becomes a parallel one and the inductors and capacitors are interchanged. Hence the duality principle can be applied to model a CSI from a VSI.

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