

SIMULATION REPORT

Submitted

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In

**Electrical And Electronics
Engineering**

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By

AMAL V KOSHY

ALMAS C S

ALLEN JOSEPH

AMAL SEBASTIAN

ALAN JOSEPH P J



DEPARTMENT OF ELECTRICAL AND
ELECTRONICS ENGINEERING

Albertian Institute of Science and Technology-AISAT

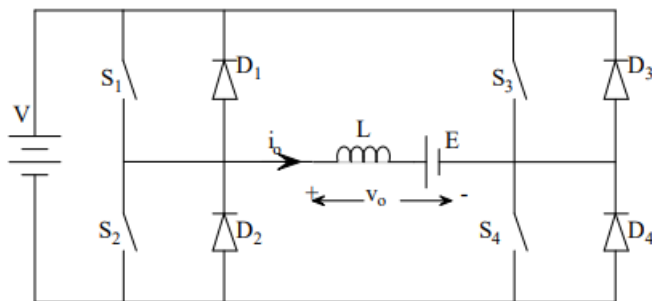
Kalamassery –Kochi 682022

DESIGN AND SIMULATION OF FOUR QUADRANT

CLASS E CHOPPER

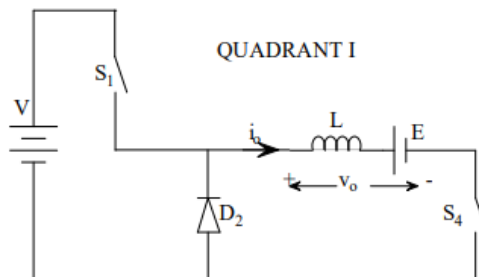
A class-E chopper is a type of dc chopper that has the capability to operate in all four quadrants of output voltage and current plane i.e., the output voltage and current can be positive or negative. In a class-E chopper power can either flow from source to load or load to source by operating it in different quadrants. A class-E chopper circuit is also called as a four-quadrant chopper.

Circuit diagram

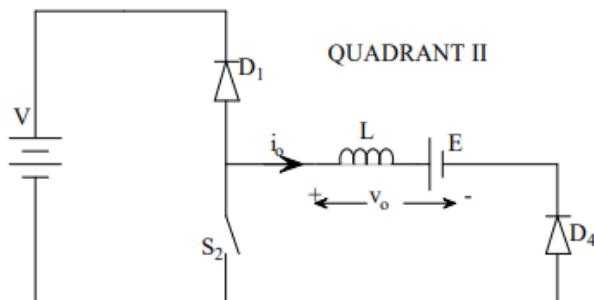


Working

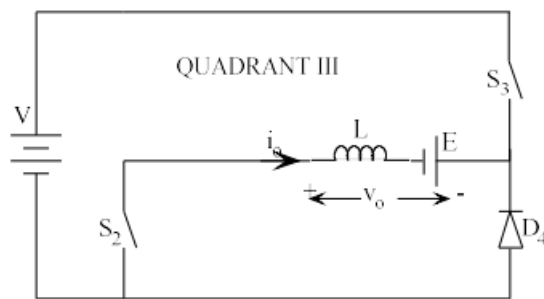
In this chopper, both the load voltage and load current may be either positive or negative. S_1 , S_4 , D_2 and D_3 constitute one type C chopper and S_2 , S_3 , D_1 and D_4 constitute another type C chopper.



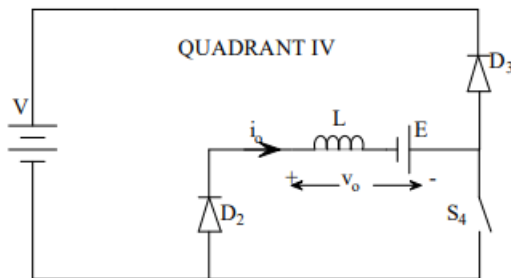
S_2 & S_4 are kept OFF;
 S_4 is kept ON;
 S_1 is operated ON & OFF
 V_o and I_o are positive



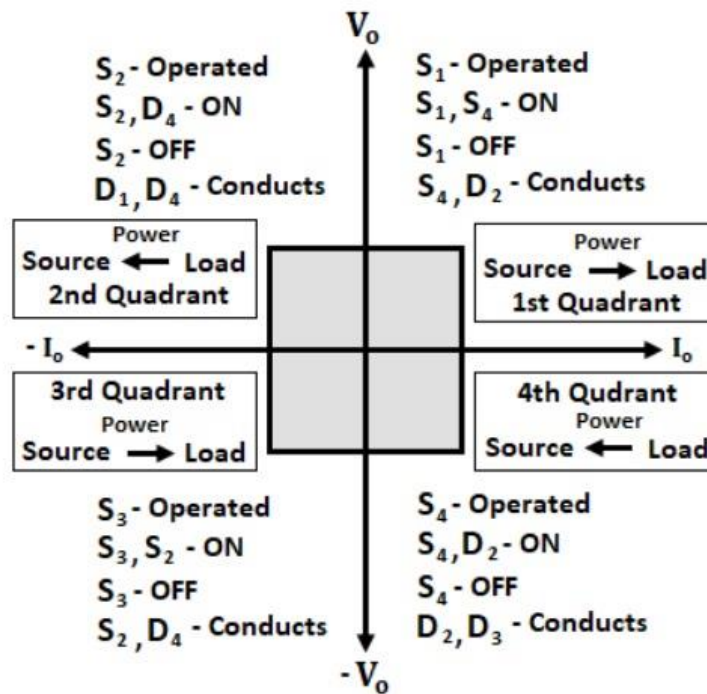
S_1 , S_3 & S_4 are kept OFF;
 S_2 is operated ON & OFF
 V_o is positive and I_o is negative



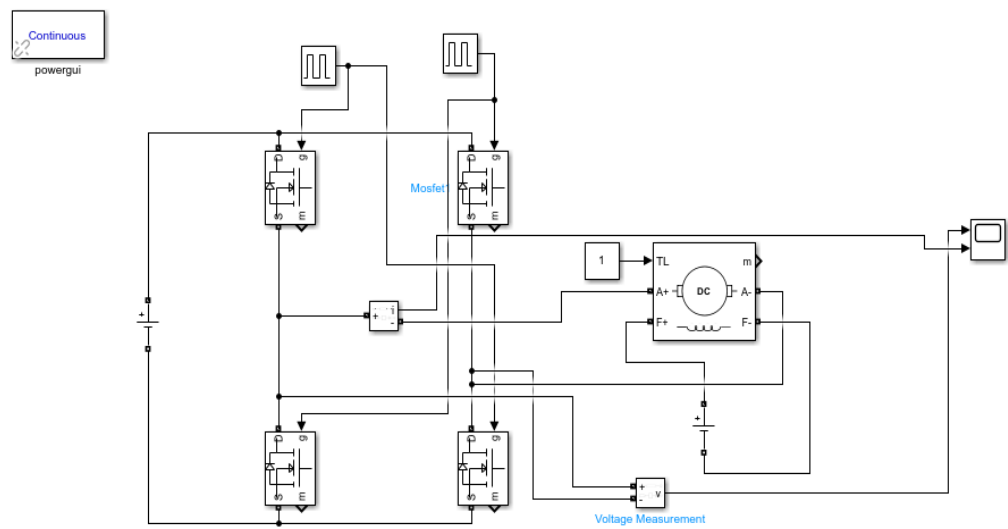
E is reversed
 S_1 & S_4 are kept OFF;
 S_2 is kept ON;
 S_3 is operated ON & OFF
 V_o and I_o are negative



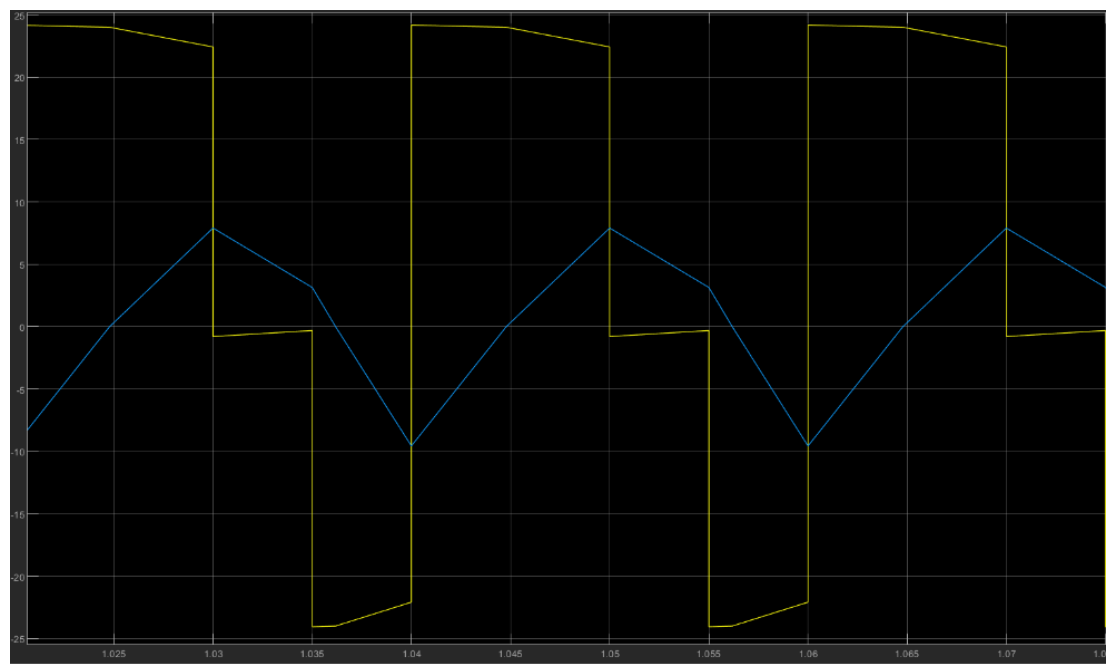
E is reversed;
 S_1 , S_2 & S_3 are kept OFF;
 S_4 is operated ON & OFF
 V_o is negative and I_o is positive



Simulation model :



Output waveform



APPLICATIONS

- A class-E chopper is used for a reversible regenerative dc motor drive where it can reverse the direction of rotation and braking in either direction.
- In the first quadrant operation, the motor operates in the forward motoring mode where it rotates in the forward direction due to positive output voltage and current. In the second quadrant operation, the motor operates in the forward braking mode where it acts as the generator. In this mode, braking is applied to the motor which opposes the motion due to which mechanical energy is converted into electrical energy which may be supplied back to the mains.
- The third quadrant operation is called reverse motoring mode where the motor direction of rotation is reversed due to negative output voltage and current. In the fourth quadrant, the motor operates in a reverse braking mode where it acts as the generator supplying power back to the mains

CONCLUSION

When the chopper operates in the first and third quadrants, the average output voltage is less than the input voltage which means the circuit works as the step-down chopper.

When the chopper operates in the second and fourth quadrants, the average output voltage is greater than the input voltage (i.e., $E + L di/dt > V_s$) which means the circuit works as the step-up chopper.

It should be taken care that at any instant switches on the same side should not be turned ON otherwise it results in a dc short circuit

