NINE-PHASE UNCONTROLLED RECTIFIER

Circuit Simulation done by

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Theory:

Conventional ac-dc converters are developed using diodes and thyristors to provide controlled and uncontrolled dc power respectively. however, these converters have problems of:

- poor power quality in terms of injected current harmonics,
- resultant voltage distortion,
- slowly varying rippled dc output at load end
- low efficiency, and
- large size of ac and dc filters

To overcome these drawbacks multiphase convertors are designed.

The circuit given below is a 9 phase rectifier. It consists of 18 Diodes named as D1, D2, D3,........ D18.For continuous conduction, one diode from the top group and one diode from the bottom group must be conducting at a time. No diode in the same leg must conduct altogether at a time. Thus the diode rectifier has 18 different conduction modes. Each conduction mode lasts for $\pi/9$ rad and each diode conducts for 40°. It produces a pulse for every 20 °.
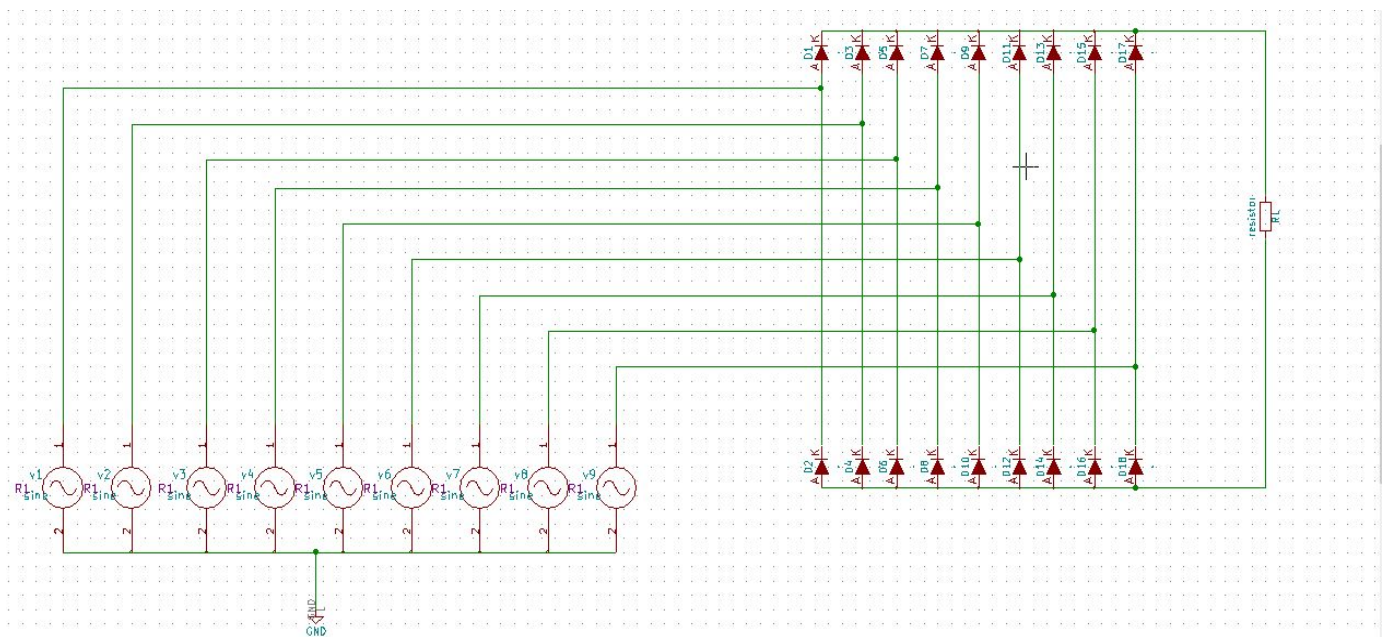

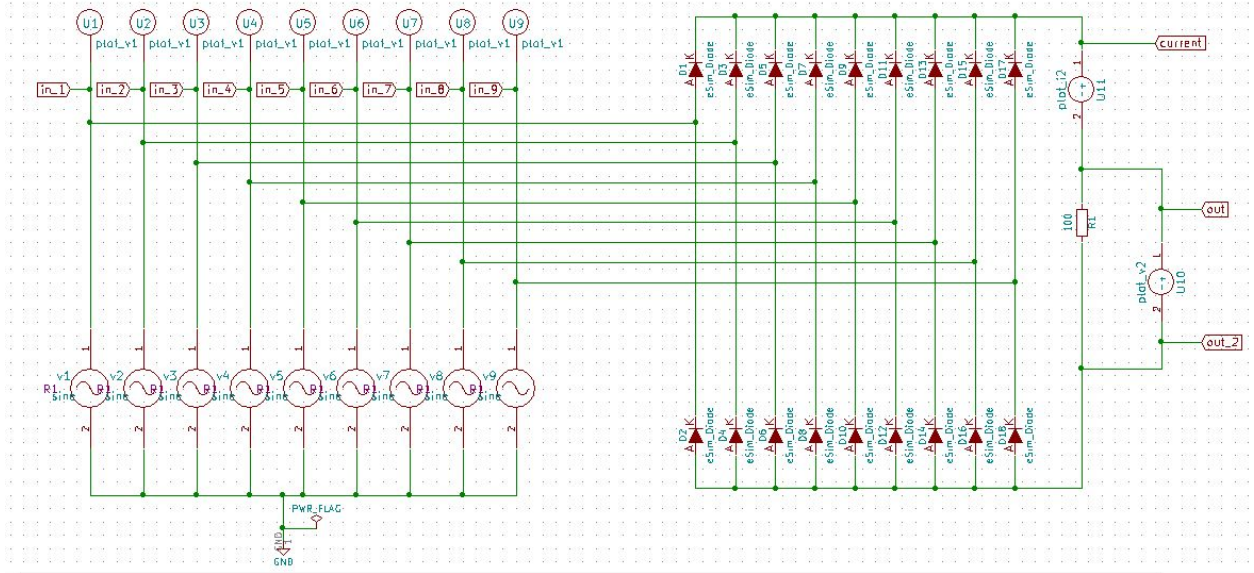Figure 1: Circuit diagram of 9 – Phase uncontrolled rectifier

Schematic Diagram:
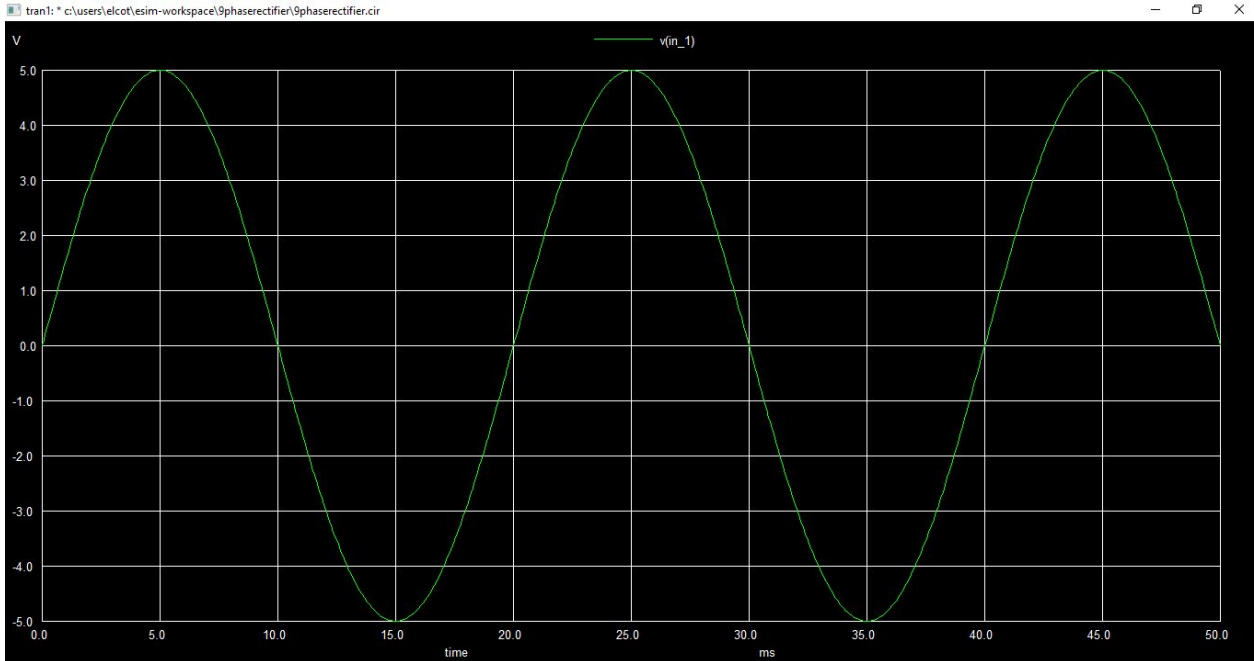

Fig 2: Schematic diagram using esim

Simulation Results:

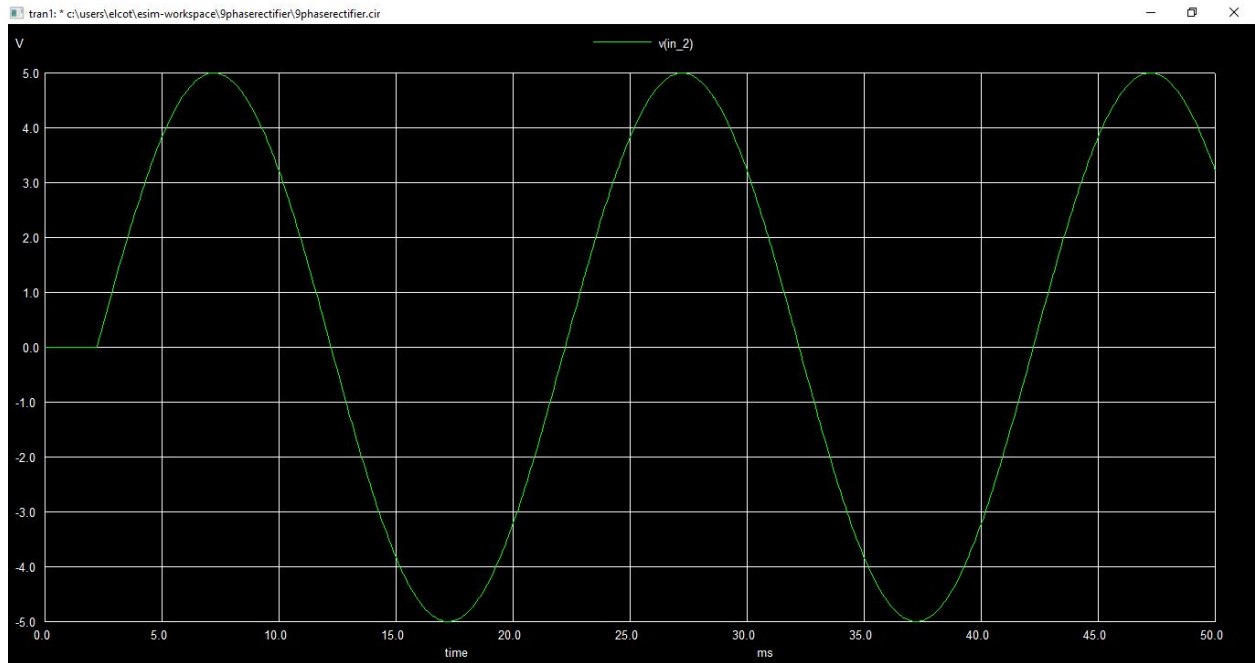Fig 3: Ngspice plot for AC input with 0° phase shift (Phase 1)

v(in_2)

Fig 4: Ngspice plot for AC input with 40° phase shift (Phase 2).
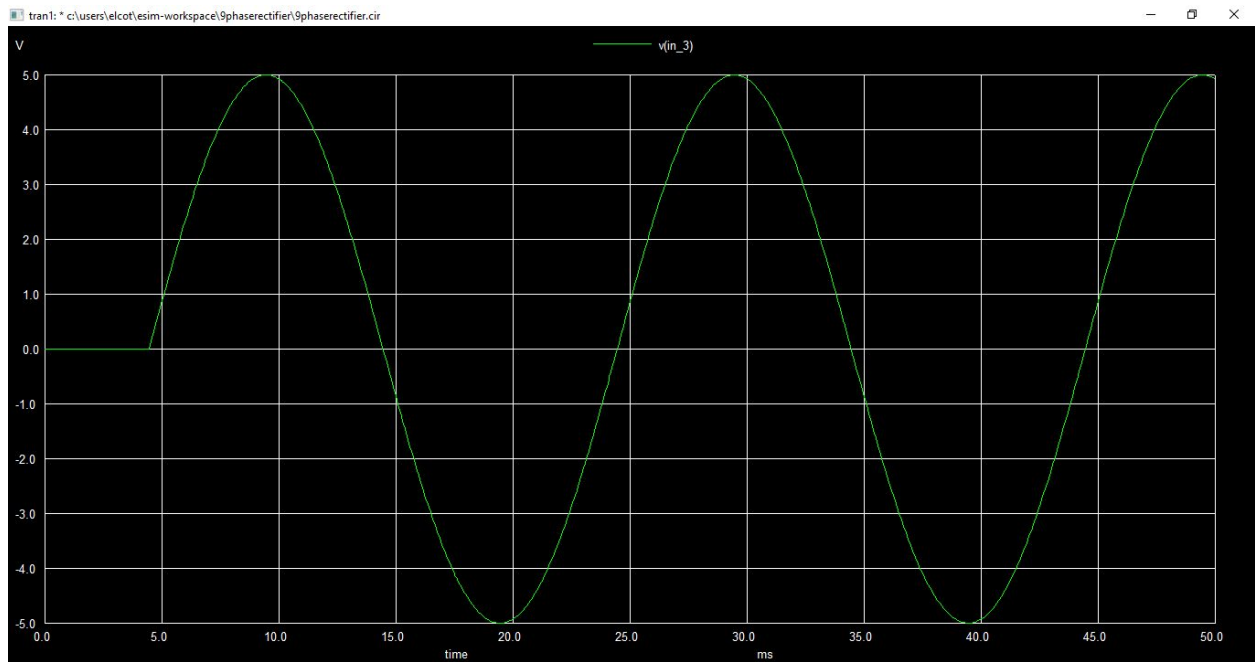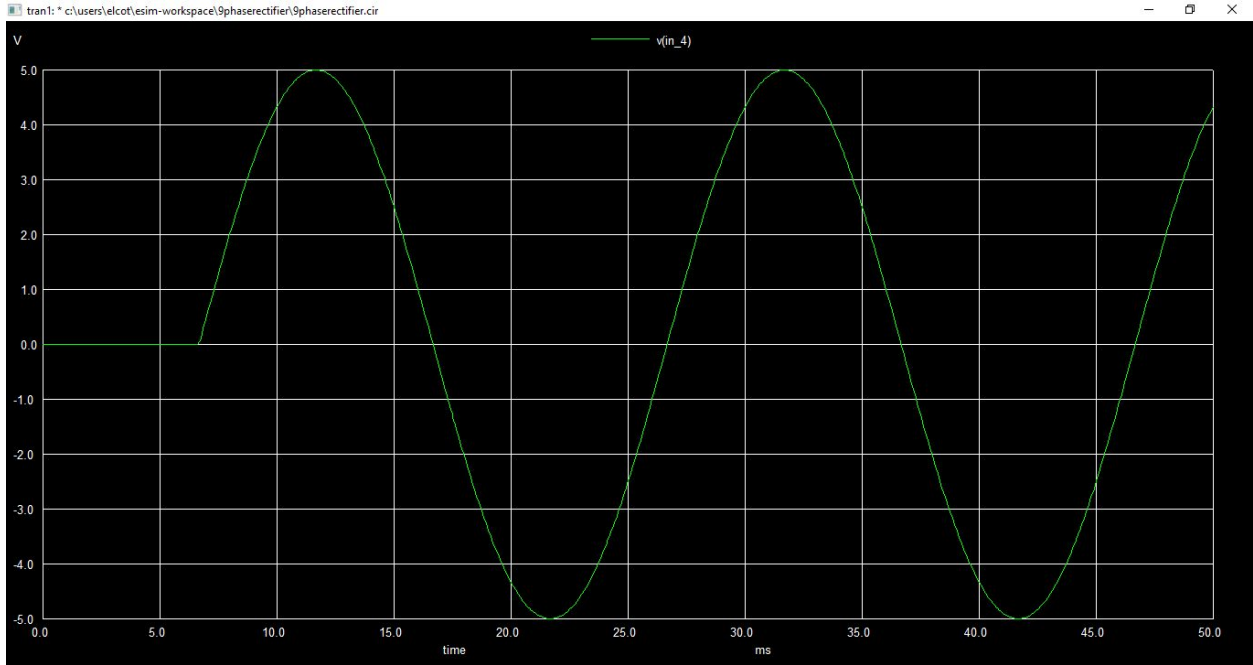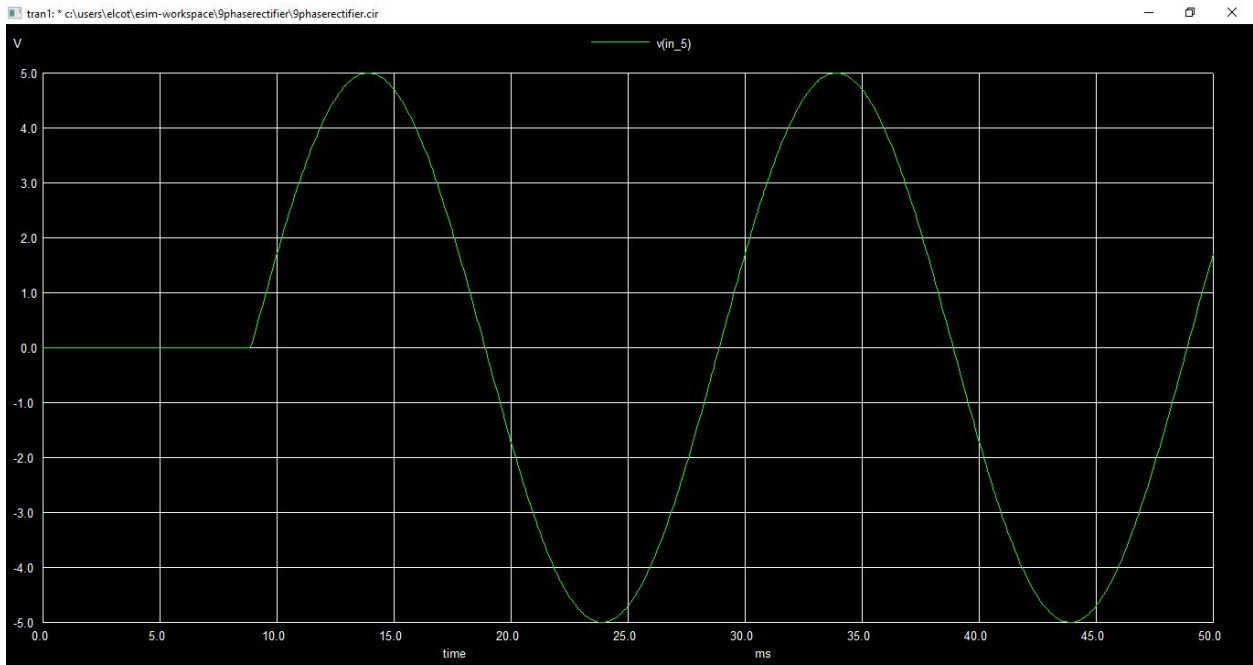
v(in_3)

Fig 5: Ngspice plot for AC input with 80° phase shift (Phase 3).

Fig 6: Ngspice plot for AC input with 120° phase shift (Phase 4).

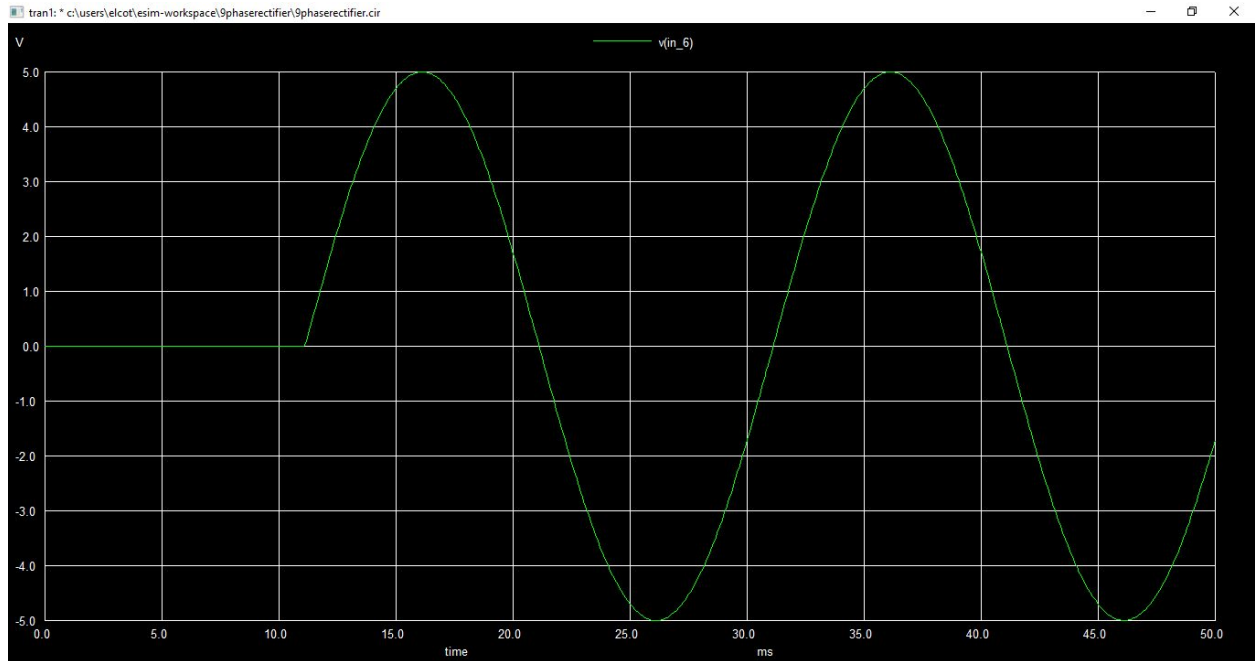Fig 7: Ngspice plot for AC input with 160° phase shift (Phase 5).

Fig 8: Ngspice plot for AC input with 200° phase shift (Phase 6).
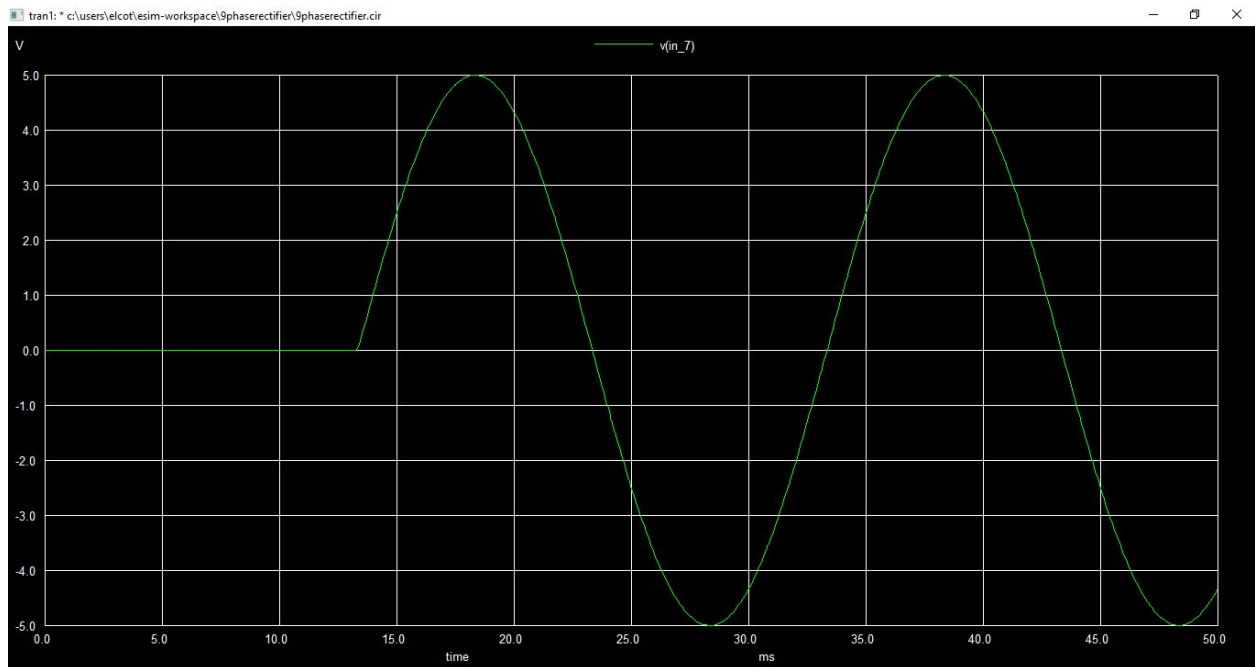

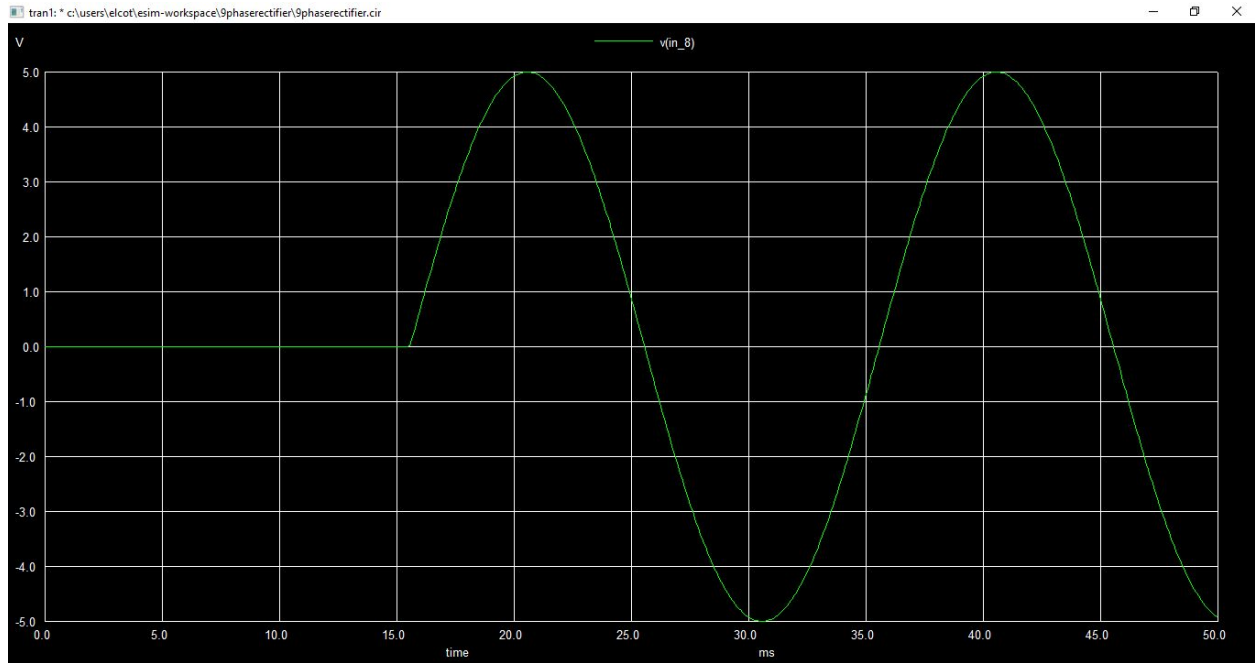Fig 9: Ngspice plot for AC input with 240° phase shift (Phase 7).

Fig 10: Ngspice plot for AC input with 280° phase shift (Phase 8).
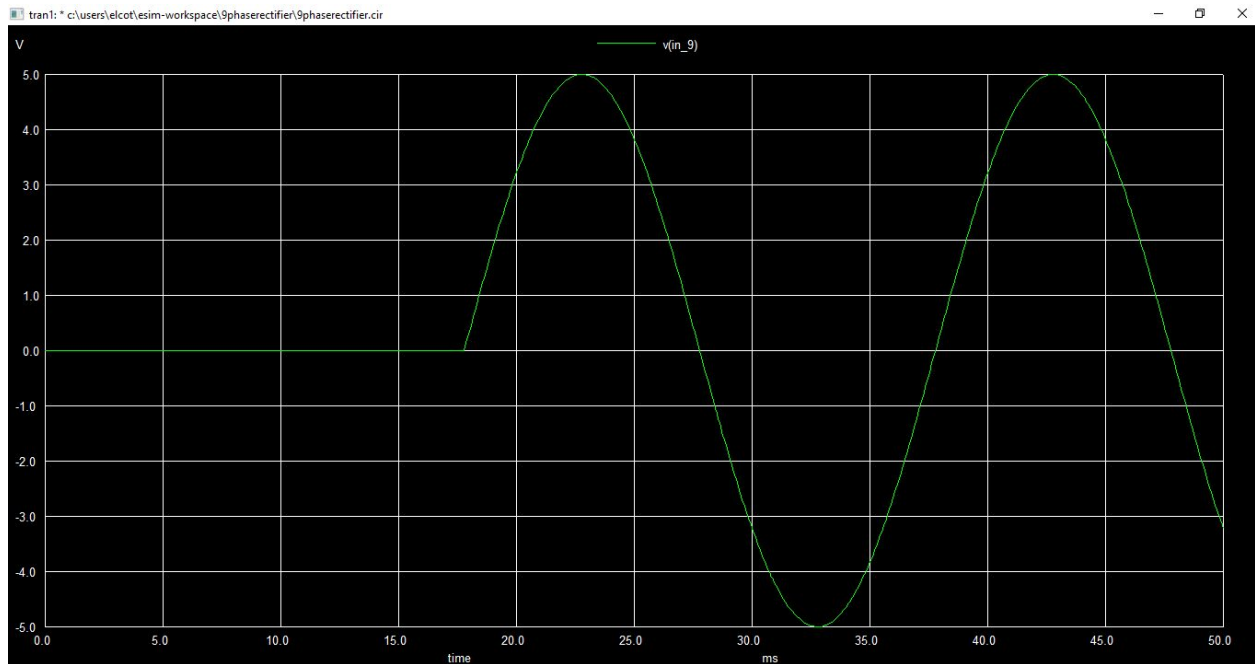

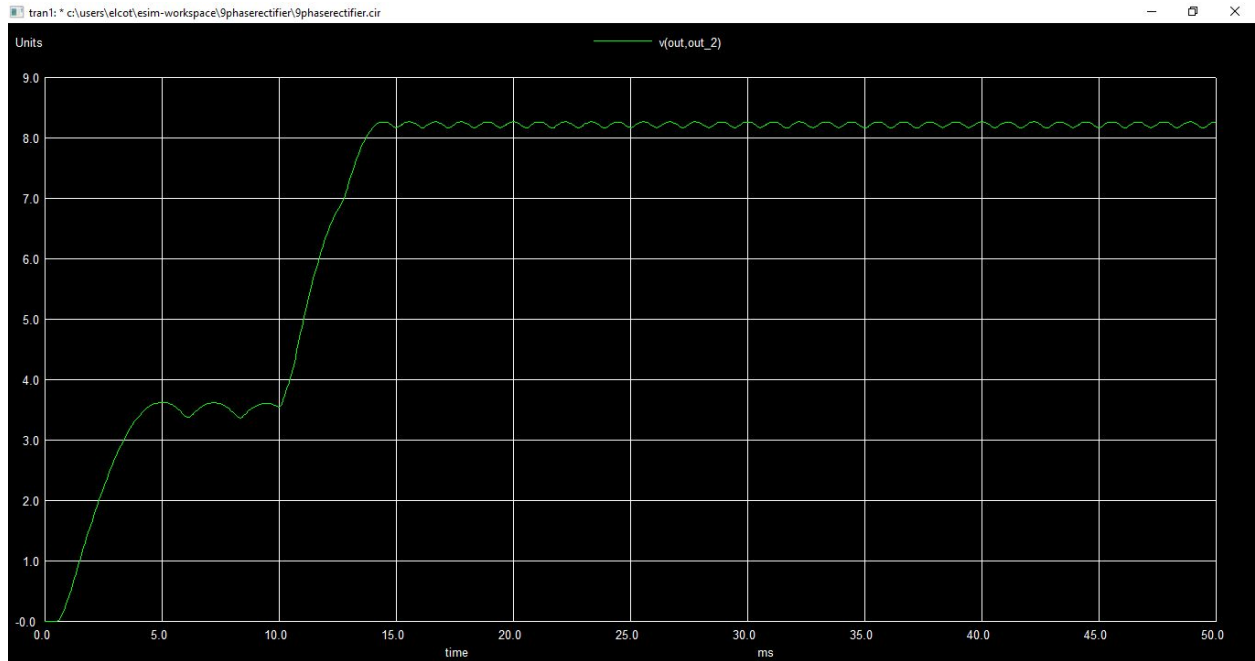Fig 11: Ngspice plot for AC input with 320° phase shift (Phase 9).

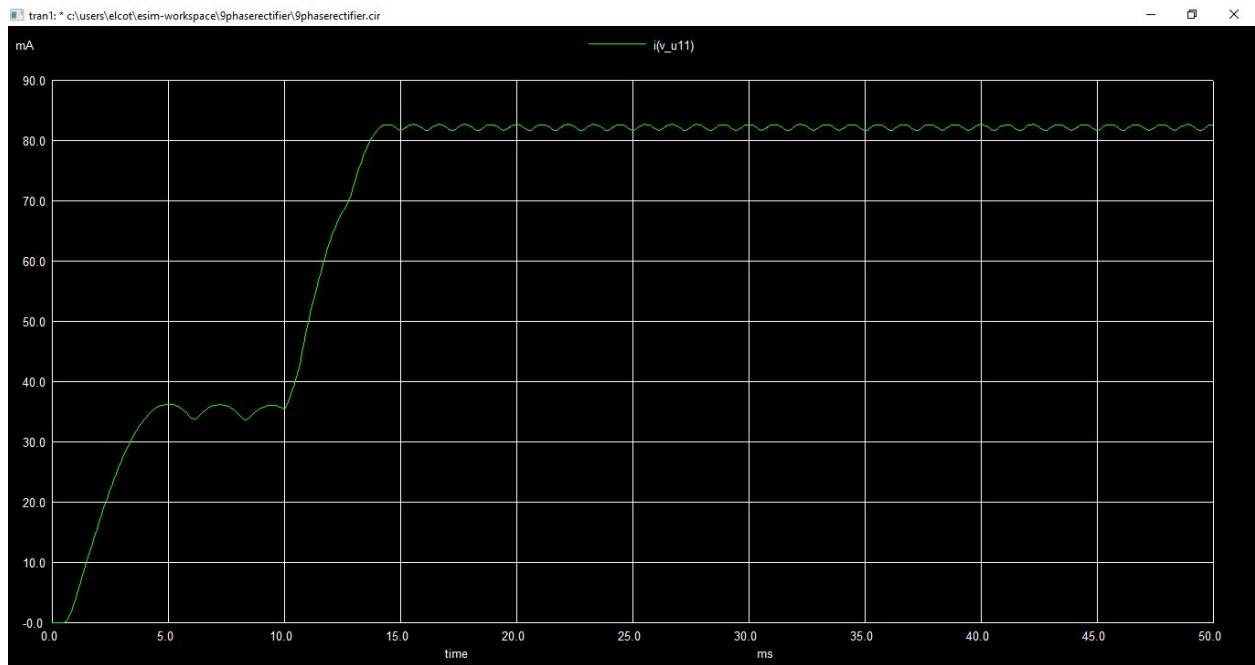Fig 12: Ngspice plot for DC output voltage (18 pulse)
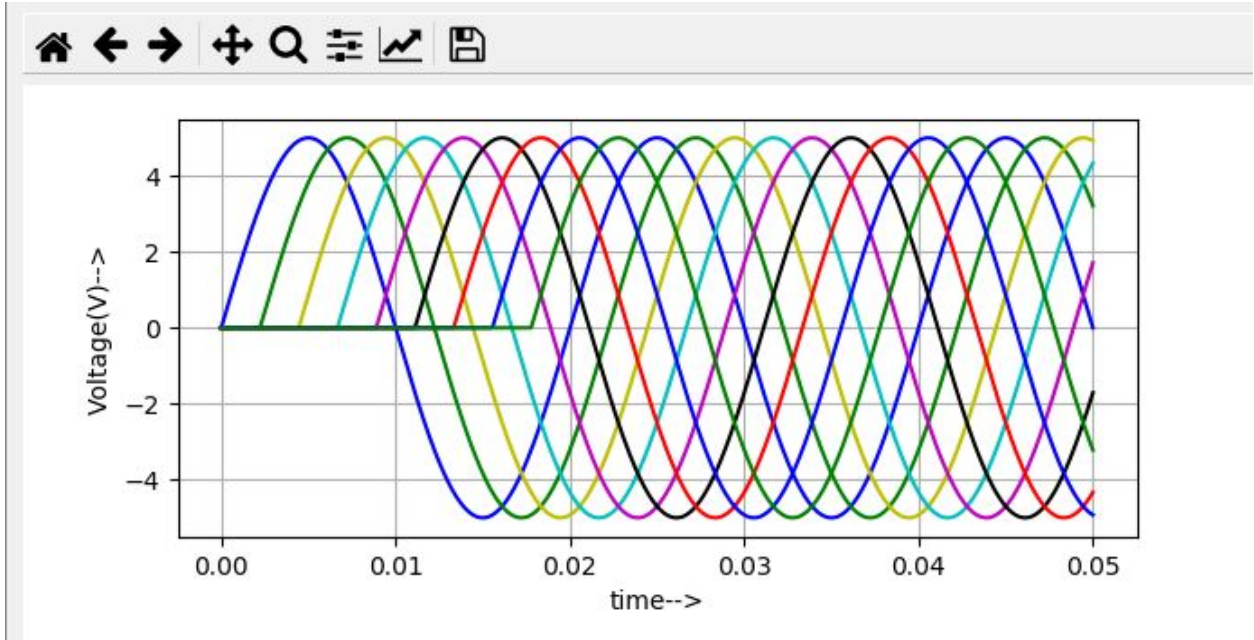

Fig 13: Ngspice plot for DC output current (18 pulse)

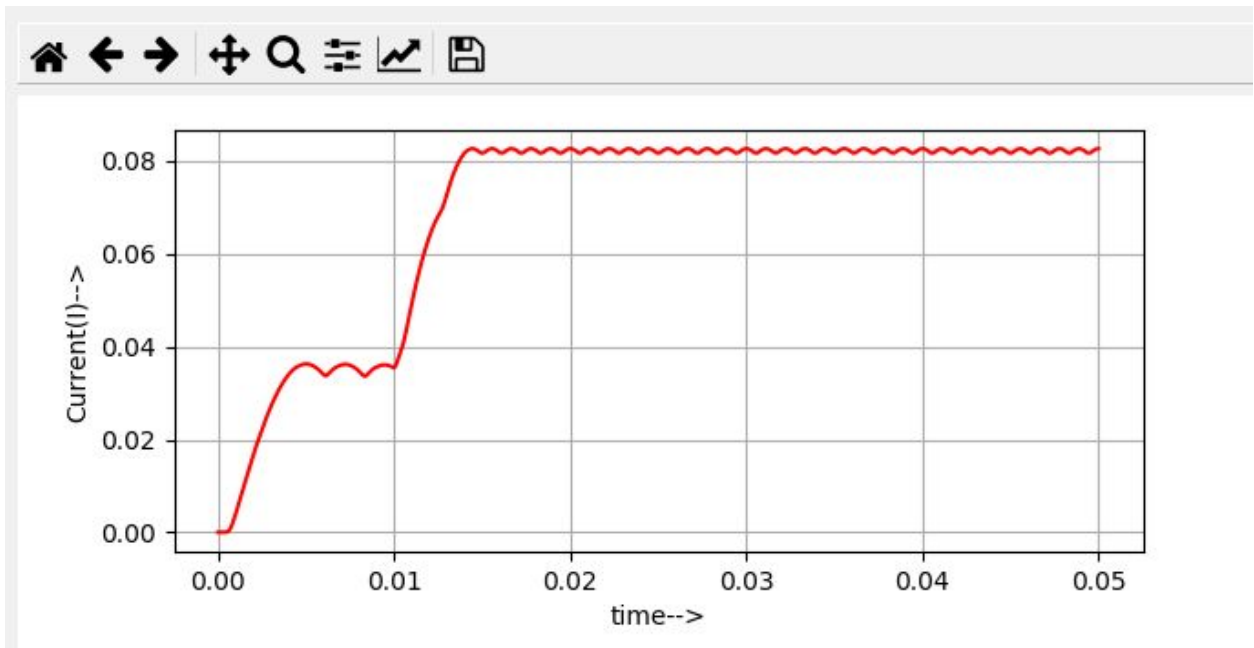Fig 14: Python plot for inputs at a phase : diference of 40°

Fig 11: Python plot for DC output current

Reference:

http://www.ijaerd.com/papers/finished_papers/18%20Pulse%20Uncontrolled%20Rectifier-54941.pdf