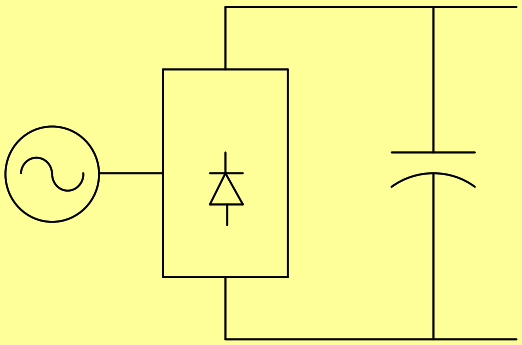
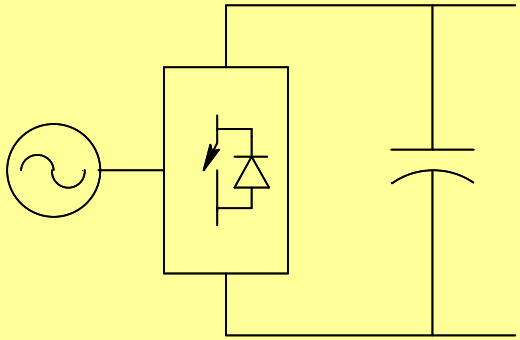
Diode Rectification of Utility Input

- Single-Phase Rectifiers
- Three-Phase Rectifiers

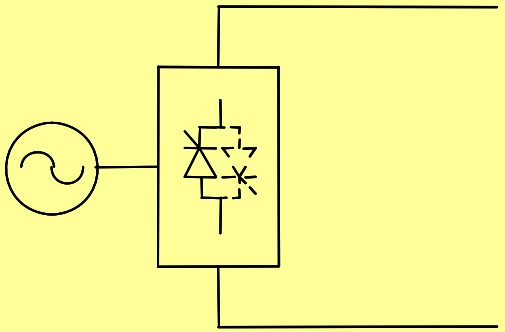
Types of Rectifier Front-Ends



(a)



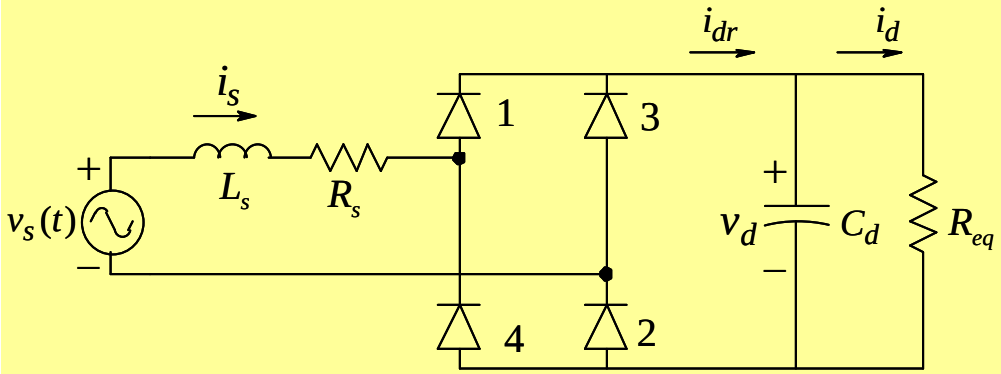
(b)



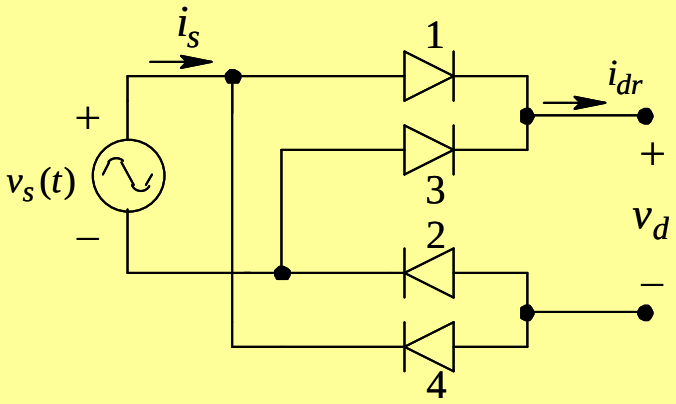
(c)

- Diode-bridge rectifiers
- Switch-mode converters
- Thyristor converter

Single-Phase, Diode-Bridge Rectifier



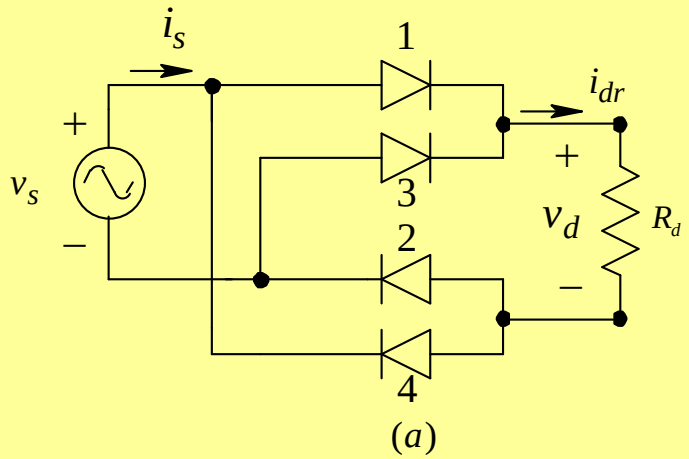
(*a*)



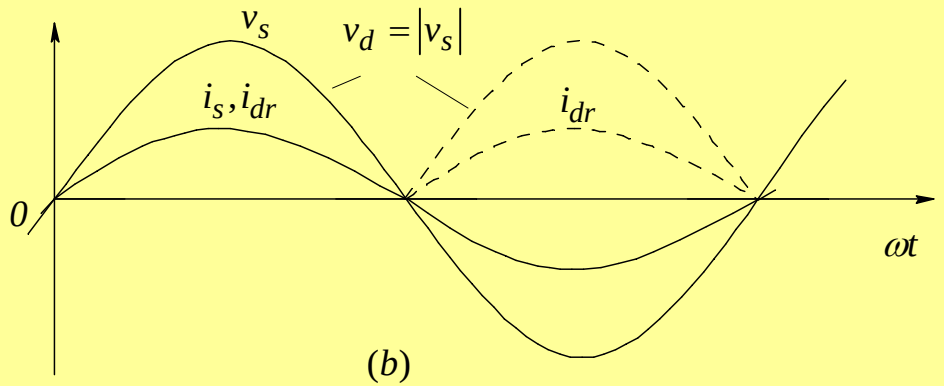
(*b*)

- Power levels up to 1-2 kW
- Current drawn from utility in short pulses

Full-bridge diode rectifier with resistive load

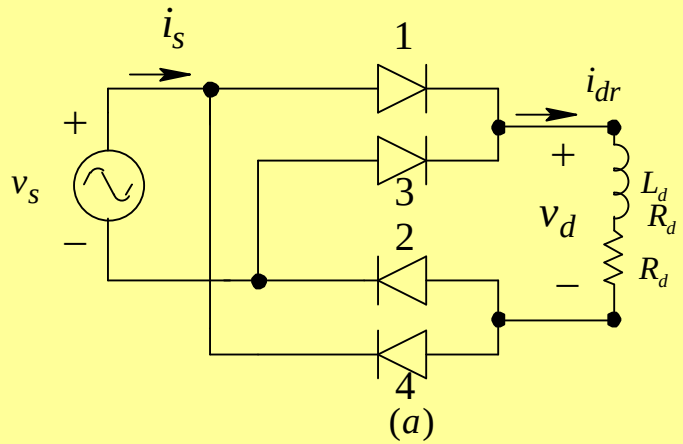


(a)

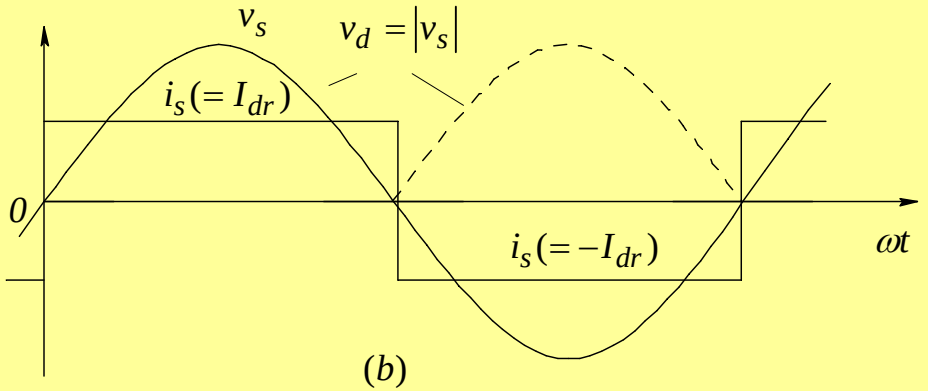


(b)

Full-bridge diode rectifier with a highly inductive load

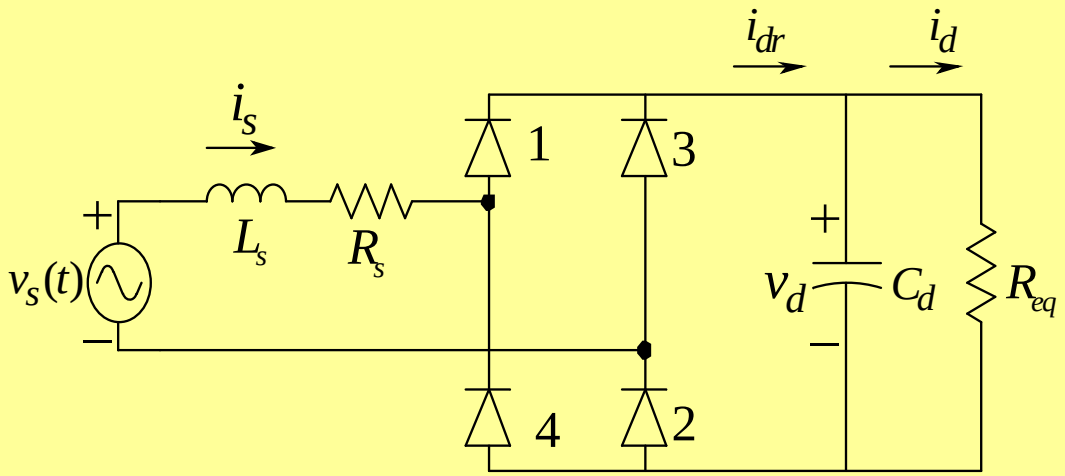


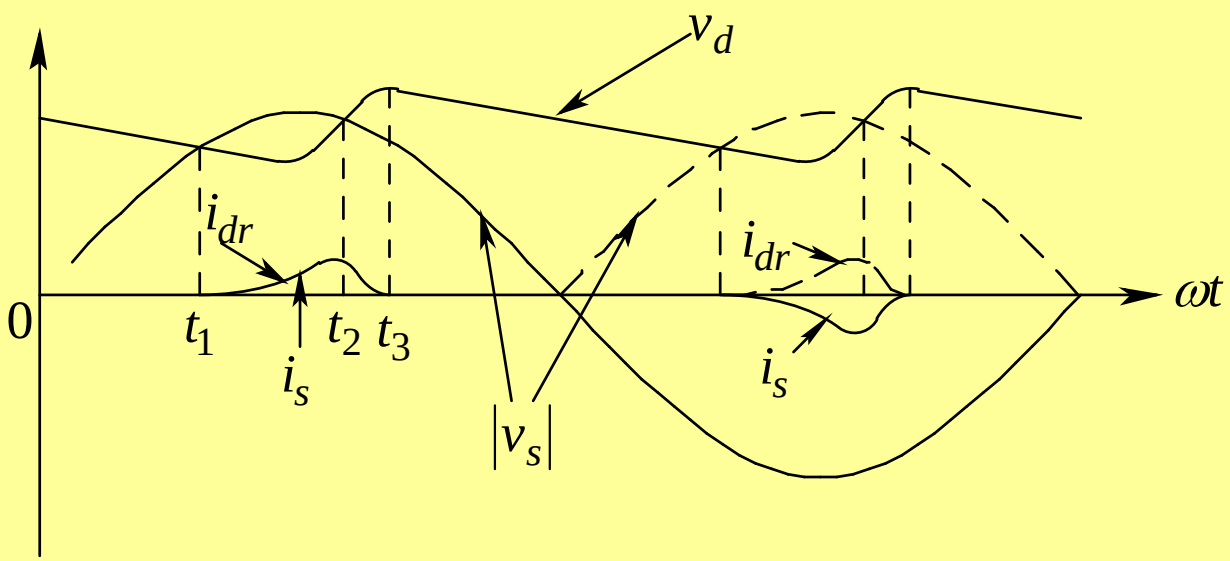
(a)

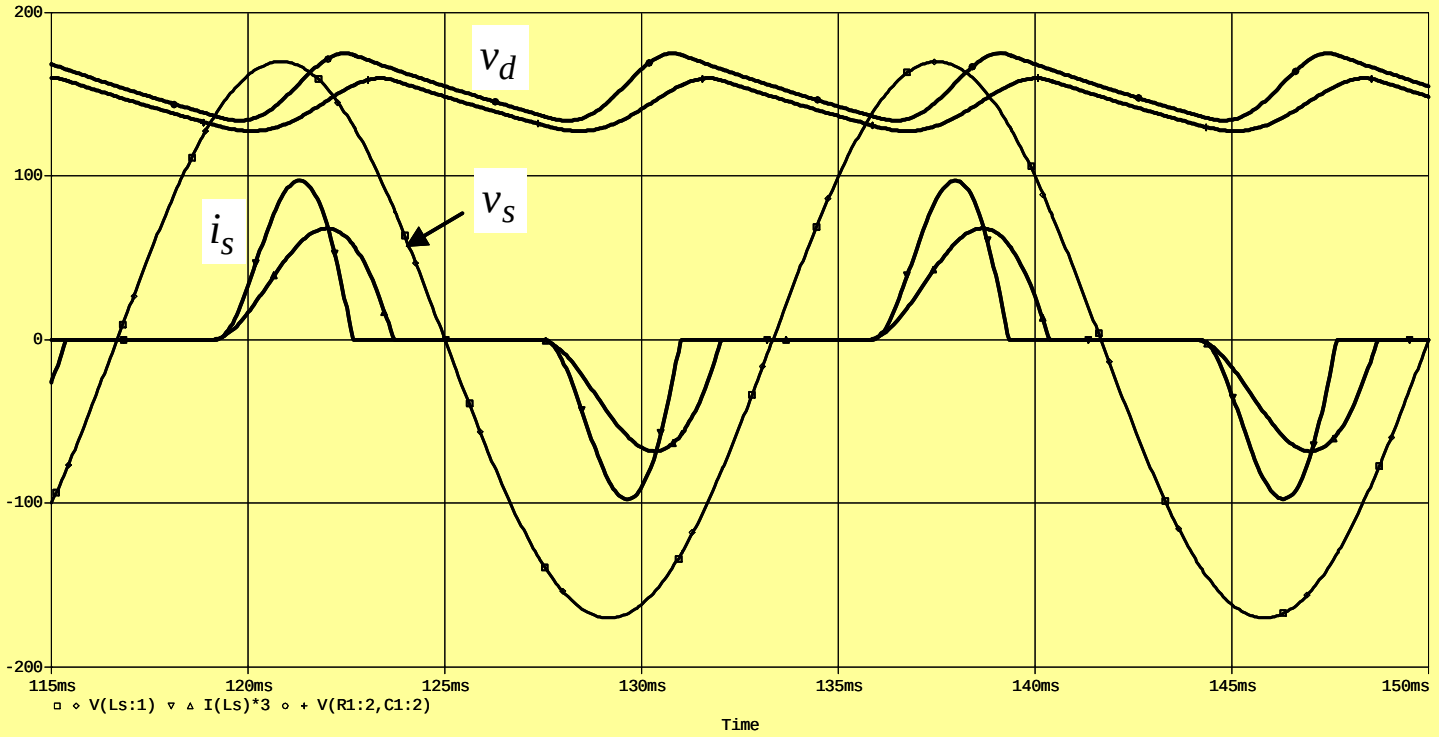


(b)

Peak-Charging Circuit

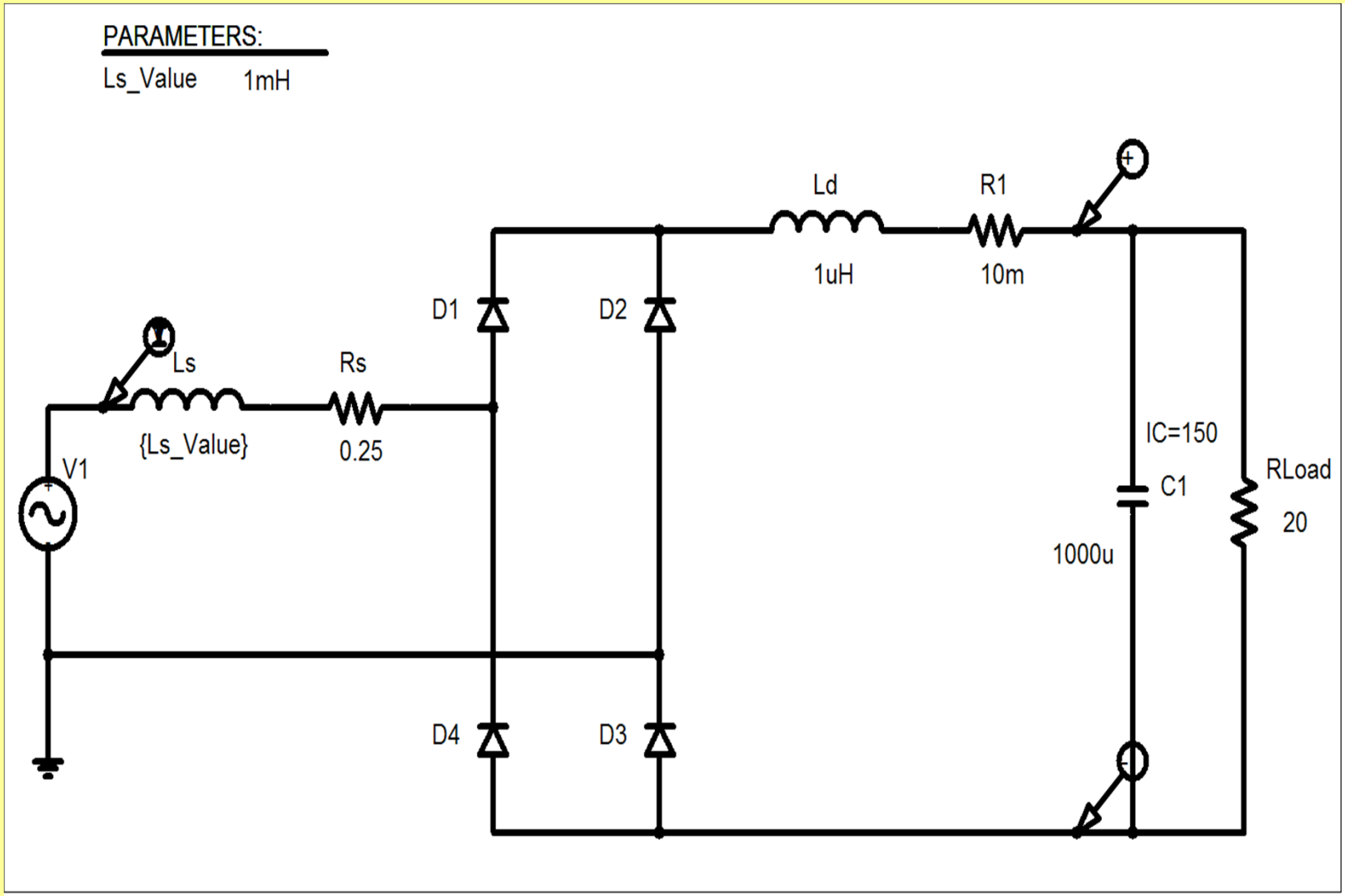




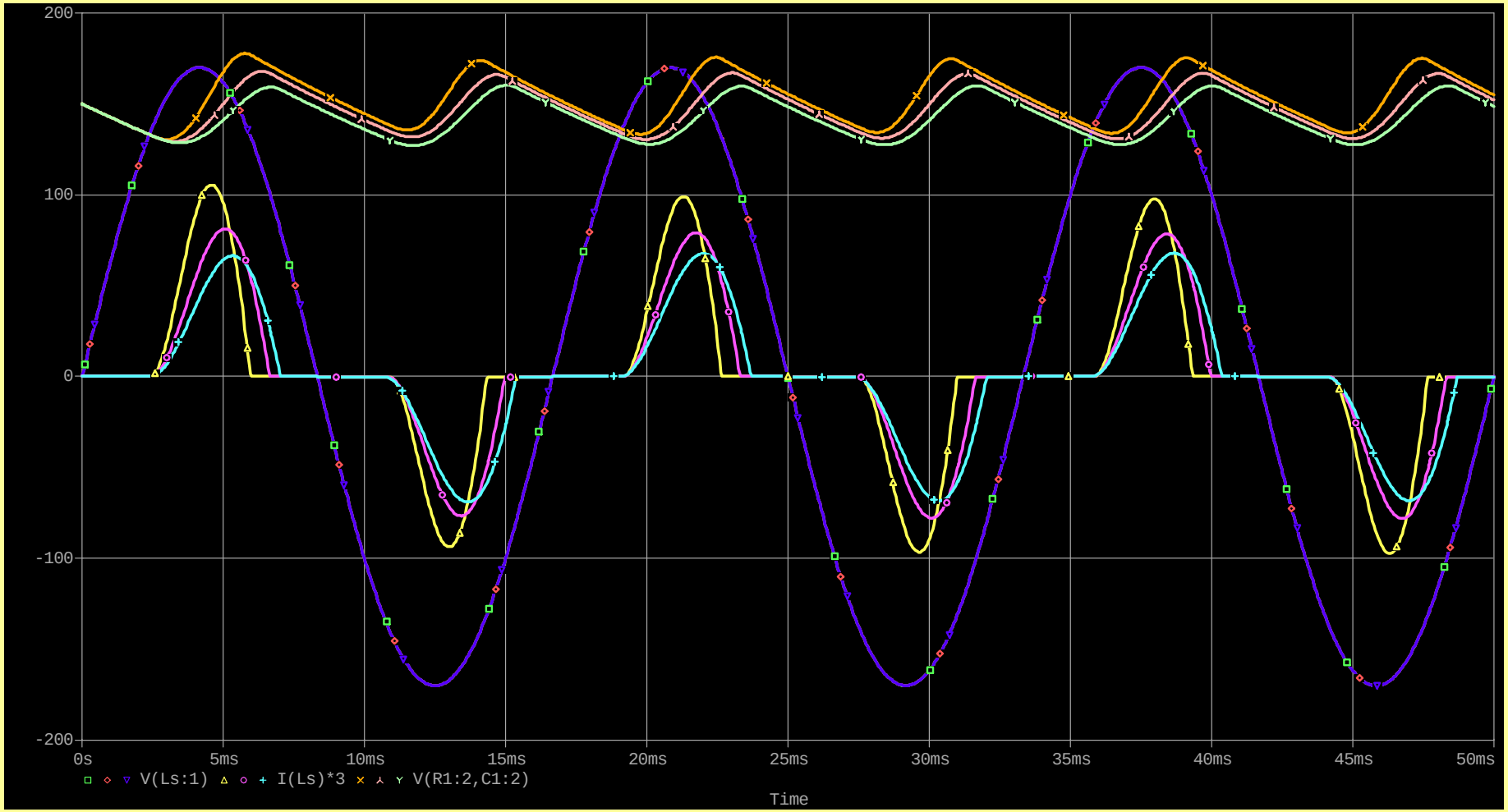


- Current pulses widen as L_s is increased

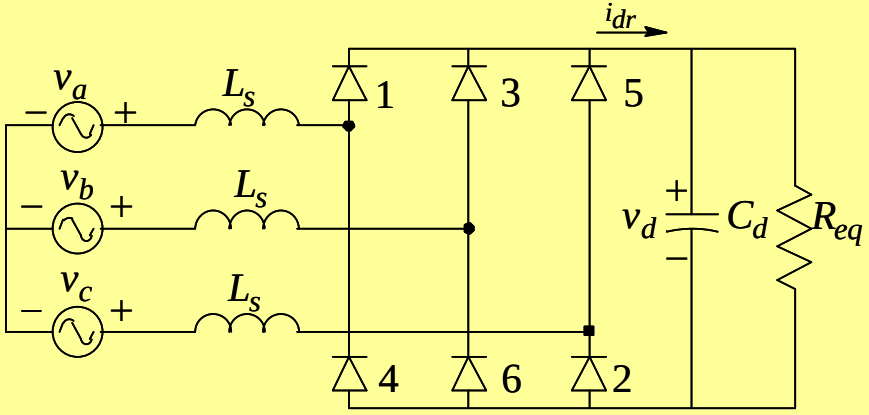
PSpice Modeling:



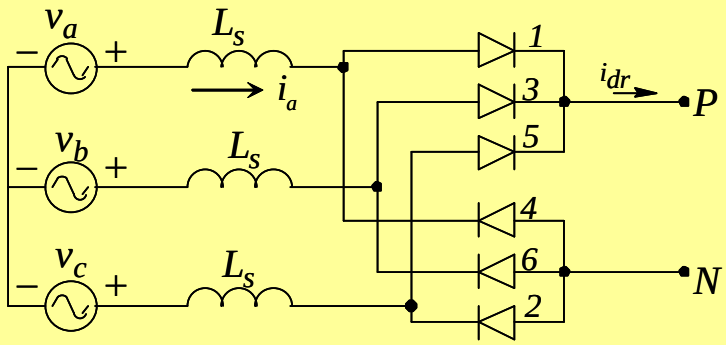
Simulation Results



Three-Phase, Diode- Bridge Rectifier

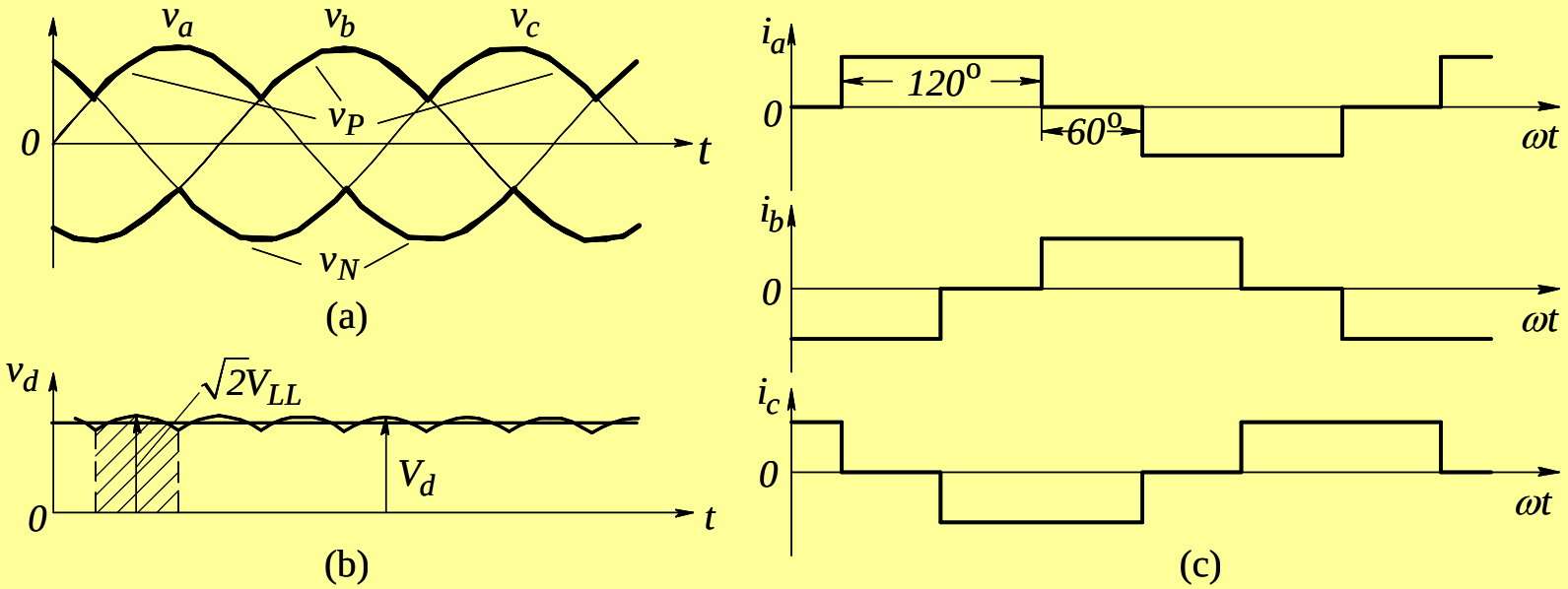


(*a*)

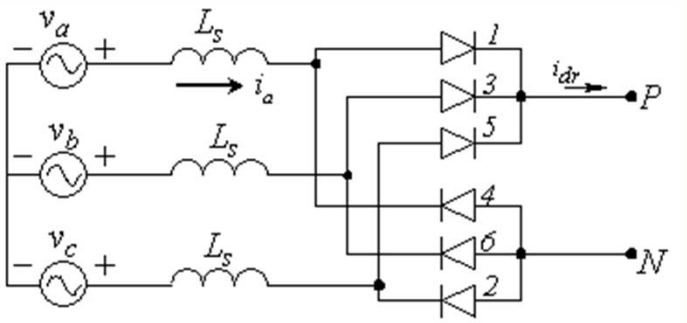


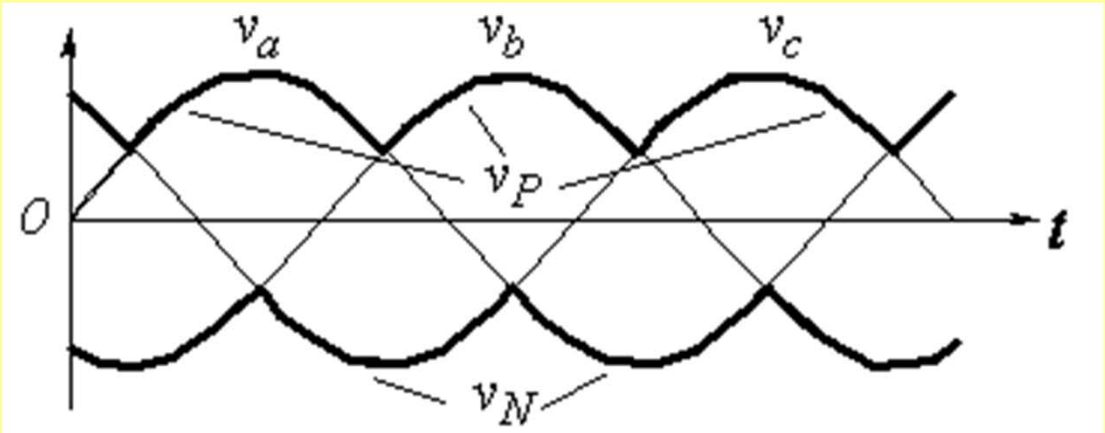
(*b*)

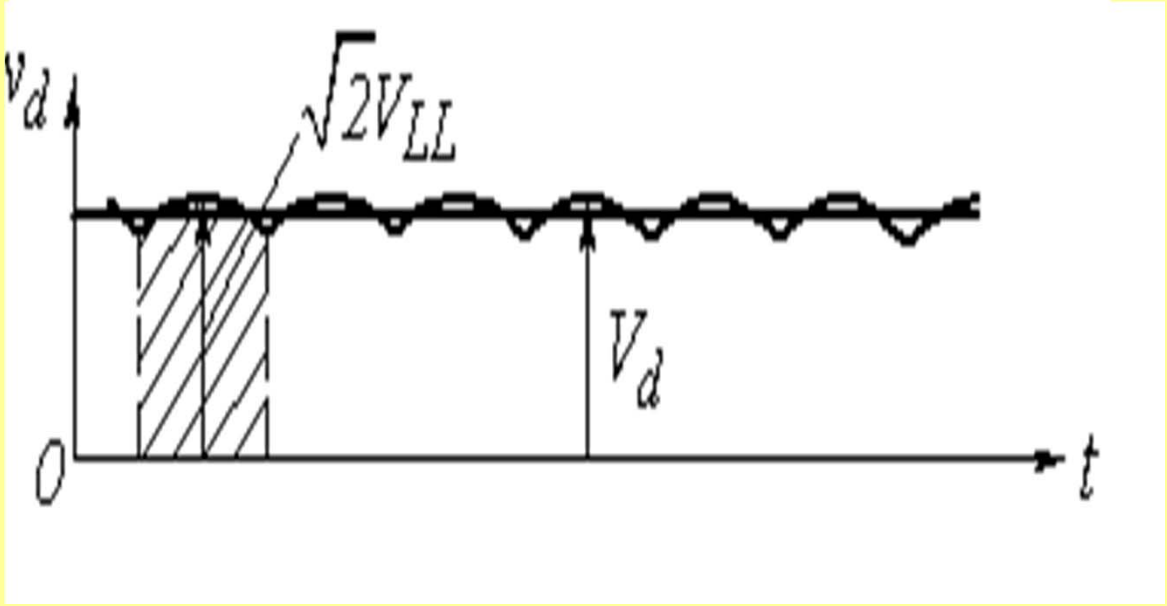
Voltage and Current Without C_d

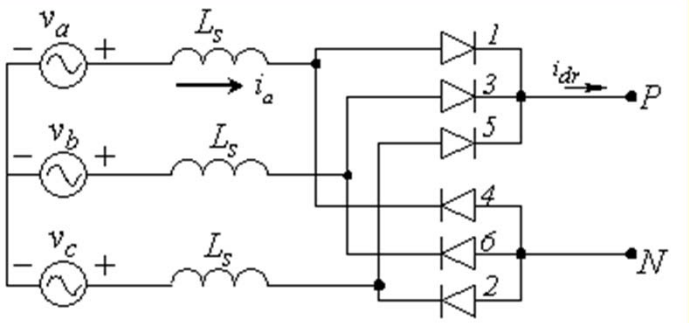


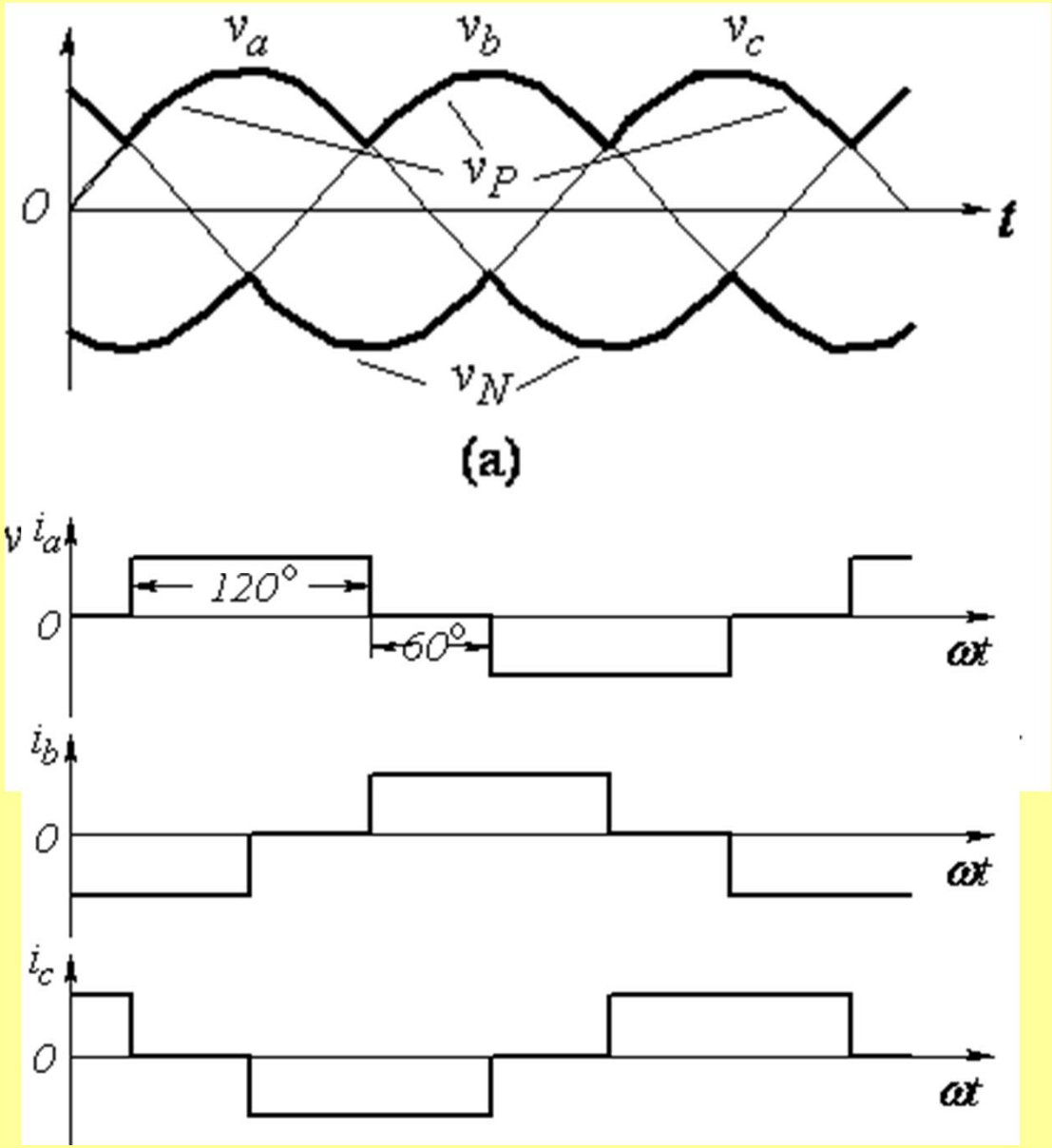
- v_P follows whichever phase voltage is most positive at any moment
- v_N follows whichever phase voltage is most negative at any moment
- Without C_d, phase currents flow for a full 120° duration



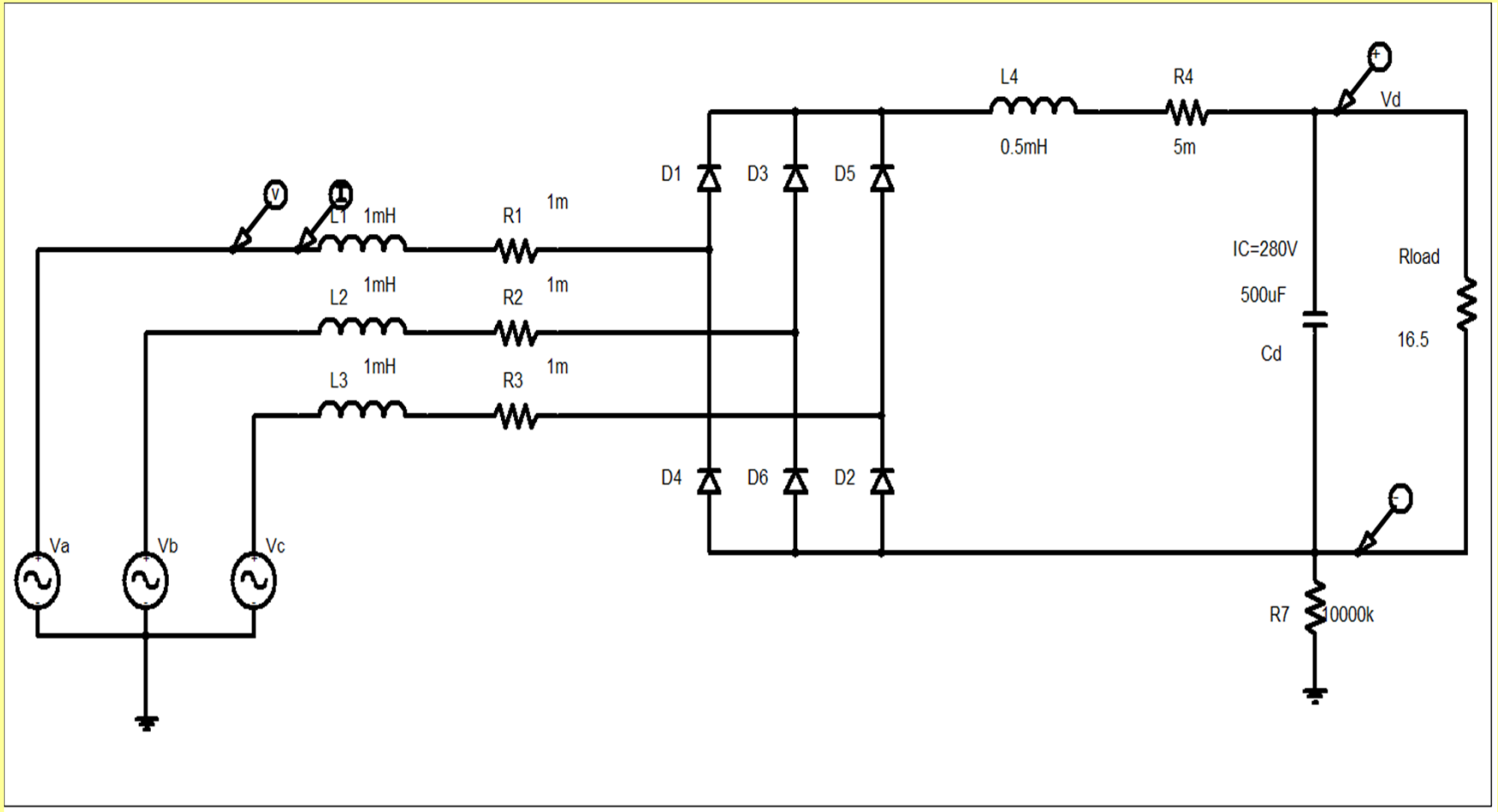




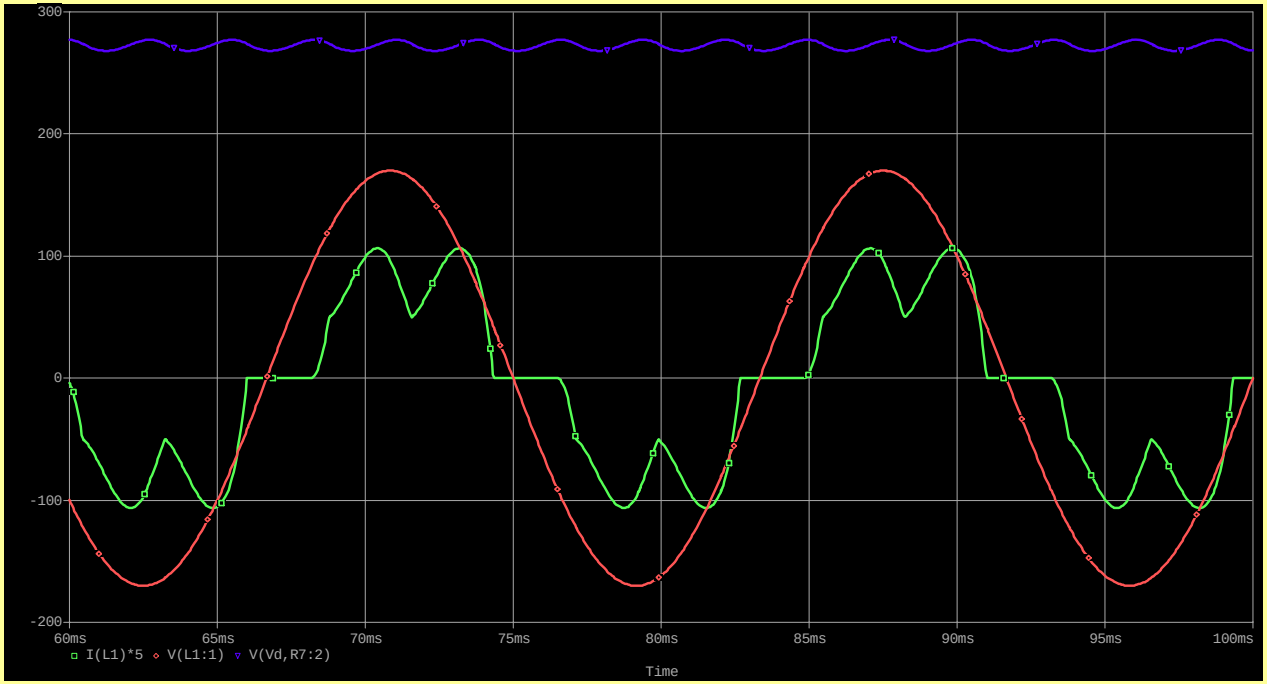


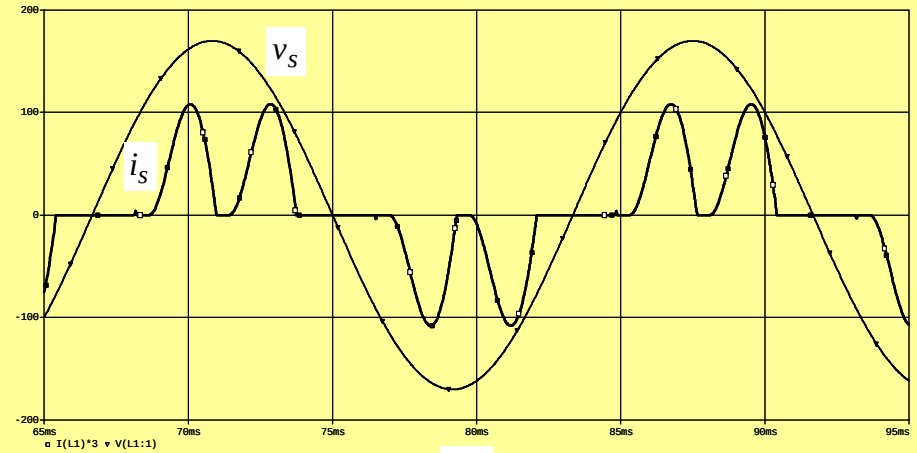


PSpice Modeling:

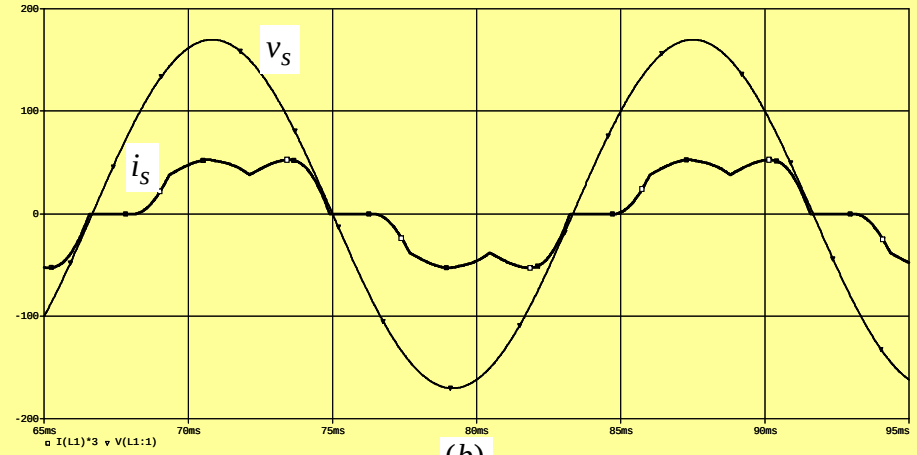


Simulation Results





(a)



(b)

Effect of L_s variation (a) $L_s = 0.1mH$; (b) $L_s = 3mH$.

Summary

Diode Rectification of Utility Input

- Single-Phase Rectifiers
- Three-Phase Rectifiers