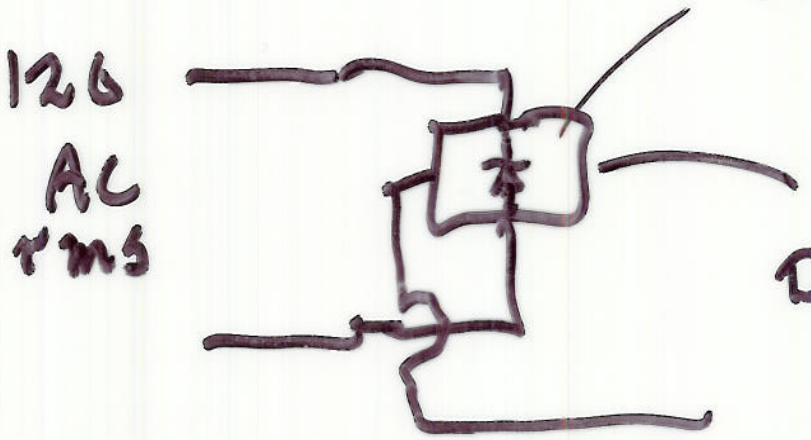
FWBR

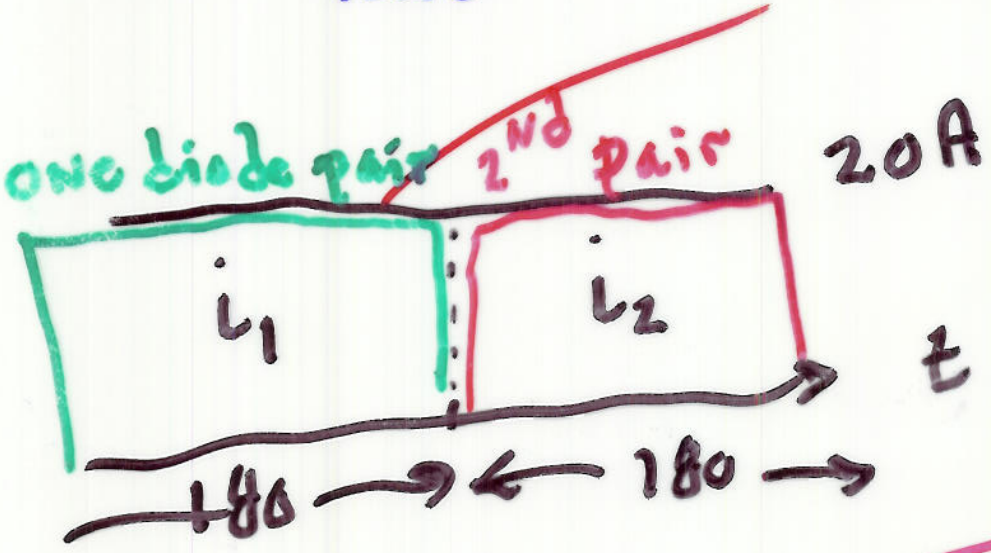


$DC \approx .9\,(120_{rms})$

$\approx 108V$

if $I_{load}^{DC} = 20\,A$

each diode is $i_D(t)$



not rms

360

Diode

$I_{AV} = \left(\frac{180}{360}\right) 20 \approx 10\,A$

$I_{peak} = 20\,A$ $\quad I^{Rms} = ?$

} diode I_{AV} specs

PIV = ?

1φ Rectifier:

$$\text{Ripple in } \% = \frac{5.5\ P_{load}}{f_{AC}\ W_2(J)}$$

Look ahead

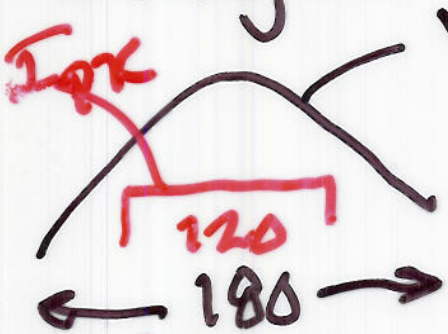
WOW!
25% less ripple
3φ rectifier!

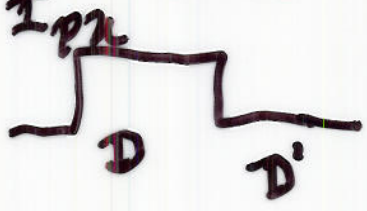
① 3φ Rectifier:

$$\text{Ripple in } \% = \frac{0.17\ P_{load}}{f_{AC}\ W_2(J)}$$

---

② Imagine the case I_{rms} (effective) = ?

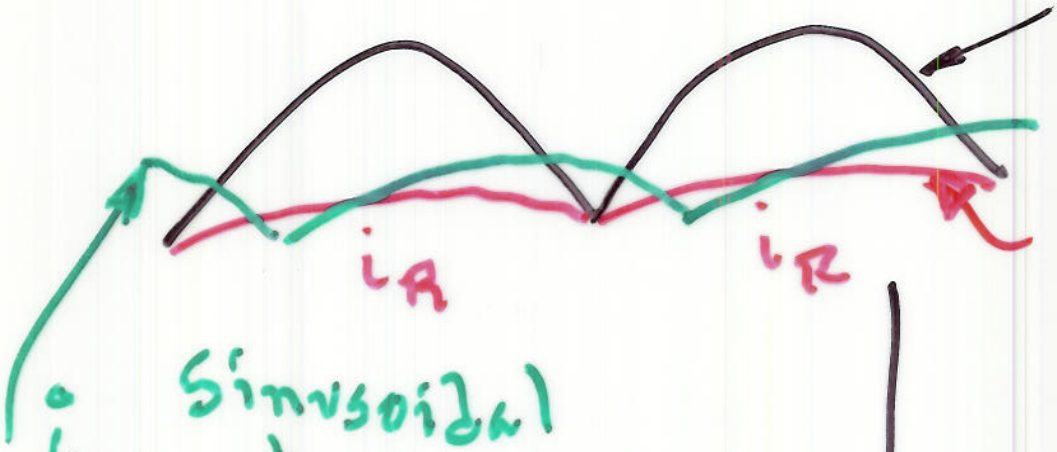




$$I_{rms} = \sqrt{D}\ I_{pk}$$

$$I_{rms}^{eff} = \sqrt{\frac{120}{180}}\ I_{pk} = \sqrt{2/3}\ I_{pk} = 0.816\, I_{pk}$$

1φ Power Factor: Passive Loads



Sinusoidal i_{R-L} to a passive R-L load

Sinusoidal i to passive resistive load follows

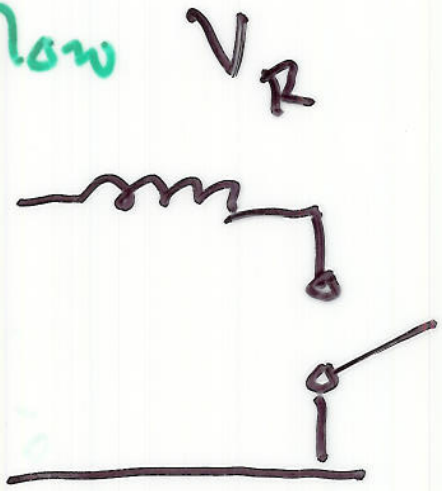
$\cos\theta < 1.0$

$\theta = 0$

$\cos\theta = 1.0$

1φ Power Factor: Active Loads

Control Z (load) to force i_{load} to follow V_R



force $i_L(t)$ to be sinusoidal

μs switch duration ⇒ small L OK

Energy Conservation

>500 million/yr AC → DC rectifers

PC's 200 million/yr

LCD/CRT 300 million/yr

i(t) does not follow V(t)

Causes "pollution" of the mains

- harmonics
- Poor power factors

New PFC regulation EN-61000-3-2

Power Electronic Switches enable PF → 1.0 saves Q grid

PFC DESIGN

boost topology allows i large at low V_{IN}

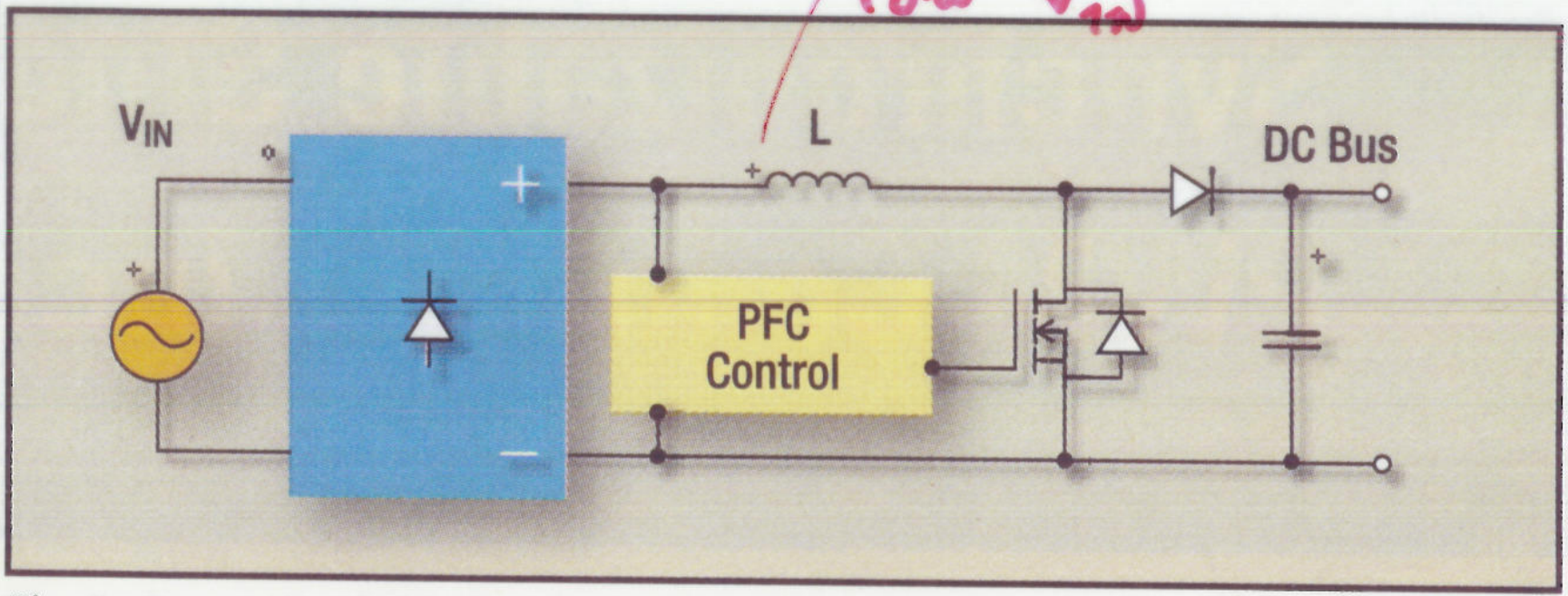


Fig. 2. *An active PFC circuit produces low THD and uses relatively small passives, but degrades power-supply efficiency because of the losses*

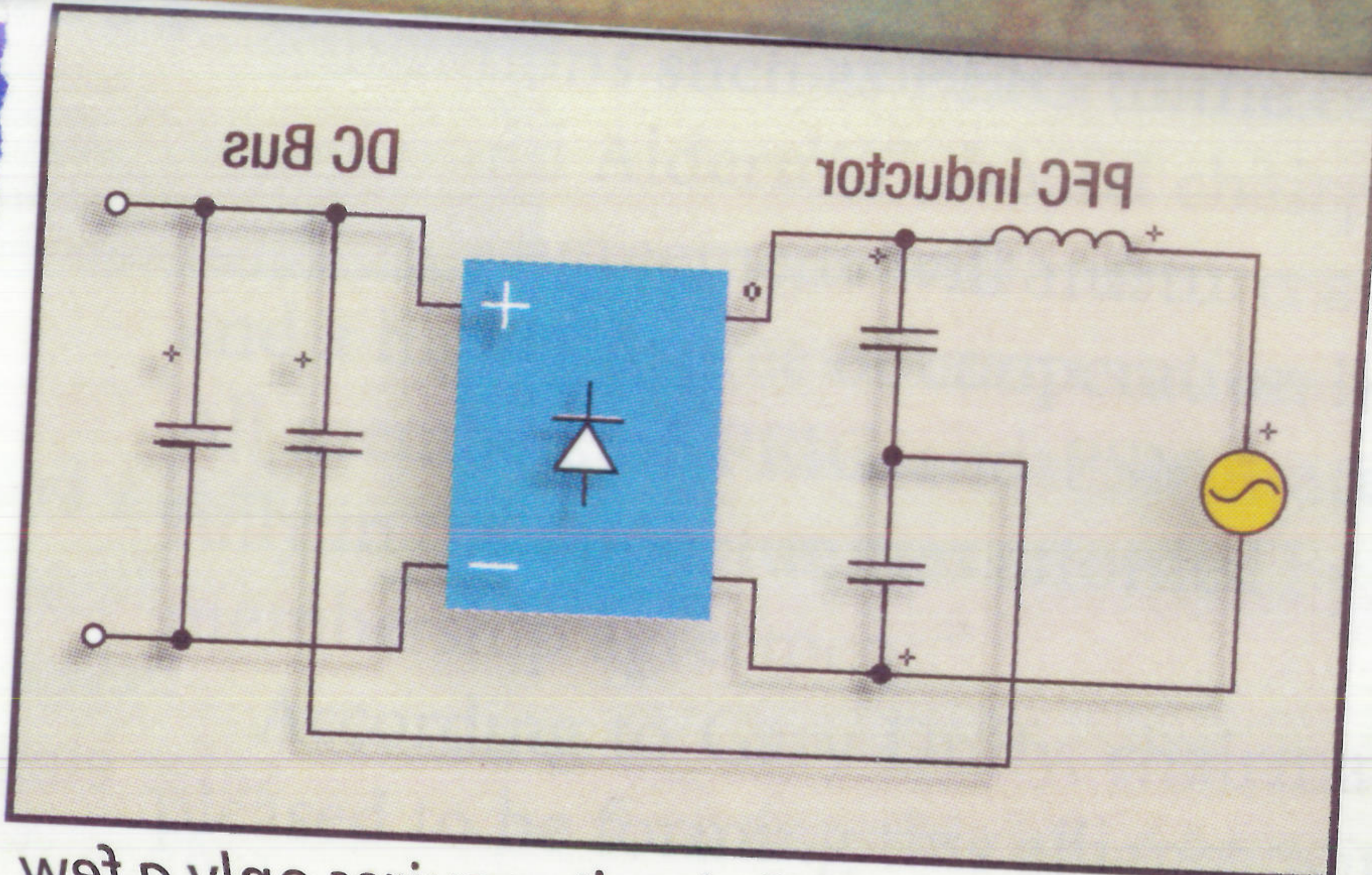


Fig. 1. A passive PFC circuit requires only a few components, but these components are large because they operate at the line frequency.