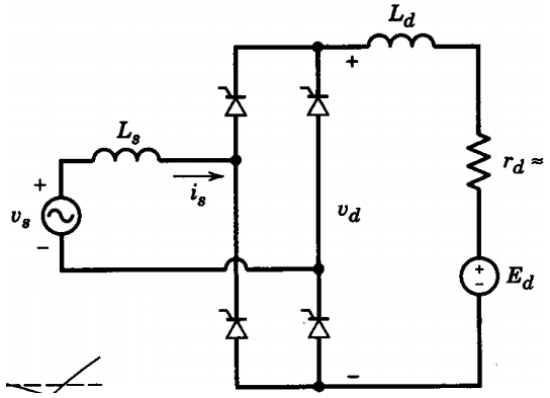
EE 442-642 HW # 3

Consider the battery charger below: Use Pspice (file name: Thyrect1ph.sch) to answer the following questions.

Let Vs = 120 V, f = 60 Hz, Ls = 1.5 mH, α = 60 deg., Ld = 10 mH, rd = 0.25Ω, Ed = 48 V



1) Analyze the source current waveform as well as the voltage wavform (at the AC-side terminals of the H-bridge) in terms of their harmonic content and THD. At what rate (i.e., power absorbed) the battery is being charged? Determine the ripple factor of the current flowing onto the battery.

Additional work for graduate students

2) Group A. Determine the firing angle that will triple the battery charging rate above.
3) Group B. Back the the original case in 1), determine the value of the inductance Ld that will limit the ripple factor of the battery current to not more than 10%.
4) Group C: Back the the original case in 1), determine the maximum value of the source inductance that will limit the voltage distortion at the converter terminals to not more than 3%.
5) Group D: Back the the original case in 1), it is now desired that that the battery supply power to the AC source at a rate of 1 kW. Determine the firing angle that is needed to achieve this.