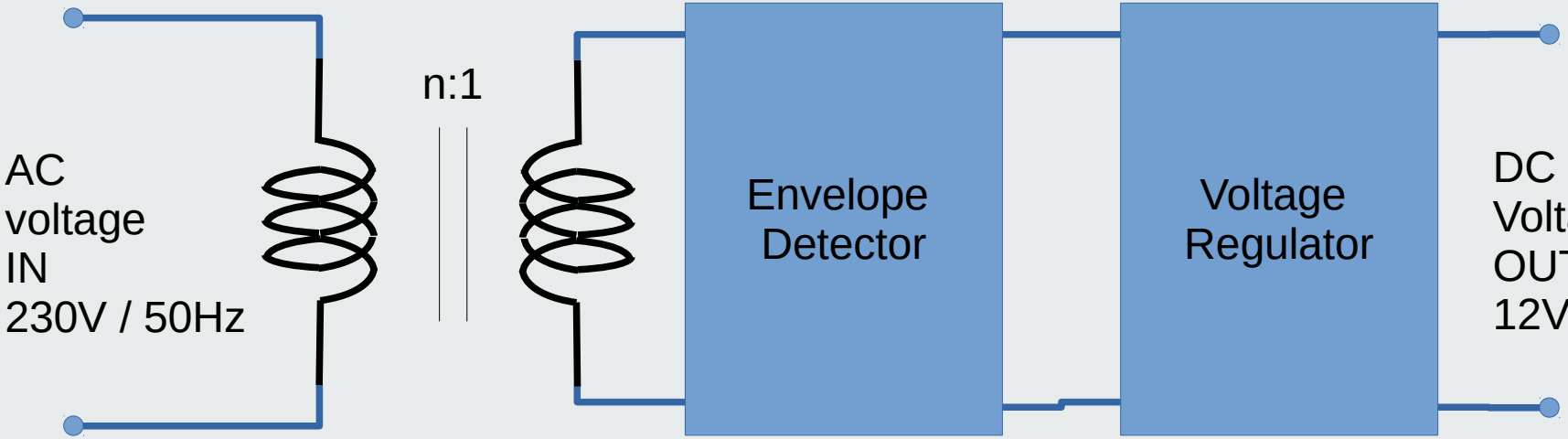
TÉCNICO LISBOA

Circuit Theory and Electronics Fundamentals

Lab 3:  Converter

AC/DC converter circuit



Based on Lecture 14, you are free to choose the architecture of the Envelope Detector and Voltage Regulator circuits
The merit M of your work is given by

$$M = \frac{1}{cost * \left(ripple\left(v_O\right) + average\left(v_O - 12\right) + 10^{-6} \right)}$$

cost = cost of resistors + cost of capacitors + cost of diodes
cost of resistors = 1 monetary unit (MU) per kOhm
cost of capacitors = 1 MU/μF
cost of diodes = 0.1 MU per diode

Simulation Analysis

1) Write an Ngspice script to simulate the AC/DC converter for 10 periods. Use the default diode model.
2) Measure the output voltage level using Ngspice's average function on at least 1000 points (should be 12V ideally)
3) Measure the output voltage ripple using Ngpice's min and max functions: ripple(v_o) = max(v_o) -min(v_o)
4) Plot the voltages at the output of the Envelope Detector and Voltage Regulator circuits
5) Plot (v_o – 12) (output AC component + DC deviation)

Suggestion: start simple and get it to work! Then think of simple changes/additions that significantly improve the figure of merit.

Theoretical Analysis

1) Use a suitable theoretical model able to predict the output of the Envelope Detector and Voltage Regulator circuits
2) Produce the same plots as in simulation by theoretical analysis
3) Compute the output DC level and the voltage ripple

Lab report

1) Produce all tables and plots required in the simulation and analysis sections
2) Compare Octave and Ngspice results side by side looking for accuracy or discrepancy, and explaining both. Read the repository's README file.
3) The results of interest are, obviously,
    - the output DC level deviation
    - the output voltage ripple
    - the cost of the components used

Evaluation criteria

1) The instructor should *git pull* your repo, and run *make flawlessly*
2) The report should not have obvious mistakes in figures, tables, formulae, section titles or main sentences
3) 1 bonus point (mark can be 5 offsetting previous grade losses) for the 5% best merit figures

    - if your work is in the top 5%, expect a more thorough review