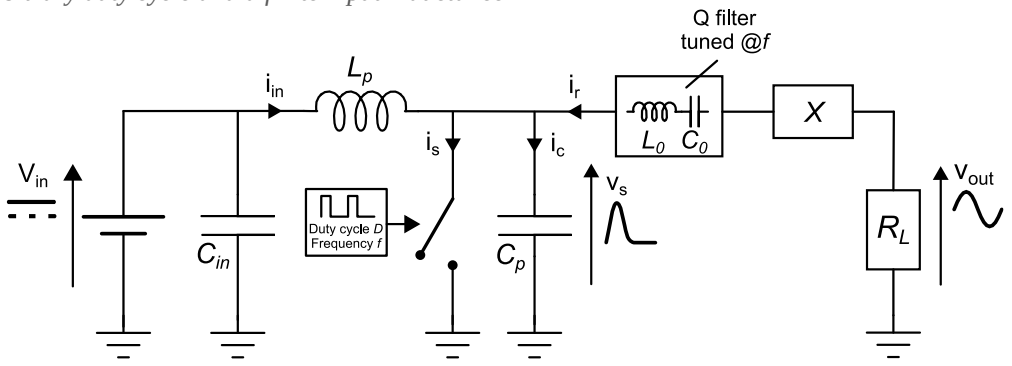
Class E inverter design

For an arbitrary duty cycle and a finite input inductance



Design assumptions

- Transistor is ideal (no power losses and instantaneous switching)
- Passive components are ideal (no power losses)
- Capacitance C_p is linear (constant)
- Input voltage V_{in} is constant
- Current i_r is sinusoidal at the switching frequency f (Q high enough)

Structure of the MATLAB script (to be downloaded at matthieubeley/class-E-design)

1) Inputs

Inputs are the duty cycle D and the q ratio. They are either scalars (for investigating a single point) or vectors (for the complete exploration of the design space).

Default vector boundaries are [0.1-0.9] for D and [0-4] for q. This can be adapted if needed.

Other inputs are the input voltage V_{in}, the switching frequency f and the load resistance R_L that will be used for the de-normalization process in step *3)*.

2) Parameters calculation (for the normalized circuit)

Analytical calculations only. All normalized parameters are obtained.

3) De-normalization

Following class E parameters are obtained.

Circuit parameters	**Voltages**	**Currents**
Input inductance L_p	Output voltage V_{out}	Input current DC I_{in}
Shunt capacitance C_p	Switch voltage fund. $V_{s_{fund}}$	Input current RMS $I_{in_{RMS}}$
Residual reactance X	Switch peak voltage V_p	Input current spectrum $I_{in_{spectr}}$
Output power P		Output current magnitude I_r
Equivalent DC input resistance R_{DC}		Switch peak current I_p
		Switch RMS current $I_{s_{RMS}}$

Contour plots for parameter ***x*** (isolines ***x***=a, ***x***=b, etc.) can be displayed using function *contour3(q,D,**x**,[a,b,…])*.

4) Waveforms

ONLY ONCE q AND D ARE SET SCALARS!

Main circuit voltages and currents can be plotted.

Voltages	**Currents**
Drive voltage v_{GS}	Output current i_r
Switch voltage v_s	Input current i_{in}
Switch voltage fundamental $v_{s_{fund}}$	Switch current i_s
Output voltage v_{out}	Shunt capacitor current i_c