Predefinition of variables

$\mu 0 := 4\pi \cdot 10^{-7} \cdot \frac{H}{m}$

$j := \sqrt{-1}$

$Po := 0W, 100W .. 1100W$

$Vpfc := 395V$

$fs := 0kHz, 1kHz .. 500kHz$

$n := \frac{22}{30}$

1. Calculation of main circuit parameter

$Lm := 72\mu H$

$Lr := 24\mu H$

$Cr := 94nF$

$fr := \frac{1}{2\pi \cdot \sqrt{Lr \cdot Cr}} = 105.962 \cdot kHz$

$fr\_ := \frac{1}{2\pi \cdot \sqrt{(Lr + Lm) \cdot Cr}} = 52.981 \cdot kHz$

Output Voltage $Vo := 360V$

The output current is: $Io(Po) := \frac{Po}{Vo}$ $Io(1100W) = 3.056\ A$

The output equivalent load resistance is: $Ro(Po) := \frac{Vo}{Io(Po)}$ $Ro(1100W) = 117.818\ \Omega$

The equivalent load resistance on primary side of tranformer can be descpribed as:

$$Re(Po) := \frac{8}{\pi^2} \cdot n^2 \cdot Ro(Po)$$

$Re(1100W) = 51.358\ \Omega$

The Q value of resonant tank is:

$$Qe(Po) := \frac{\sqrt{\frac{Lr}{Cr}}}{\left(\frac{8}{\pi^2}\cdot n^2\cdot Ro(Po)\right)} \qquad Qe(1100W) = 0.311$$

Frequency Margin for max load and max voltage

The voltage gain of DCDC converter (considerating the turn ratio is 1:1) is

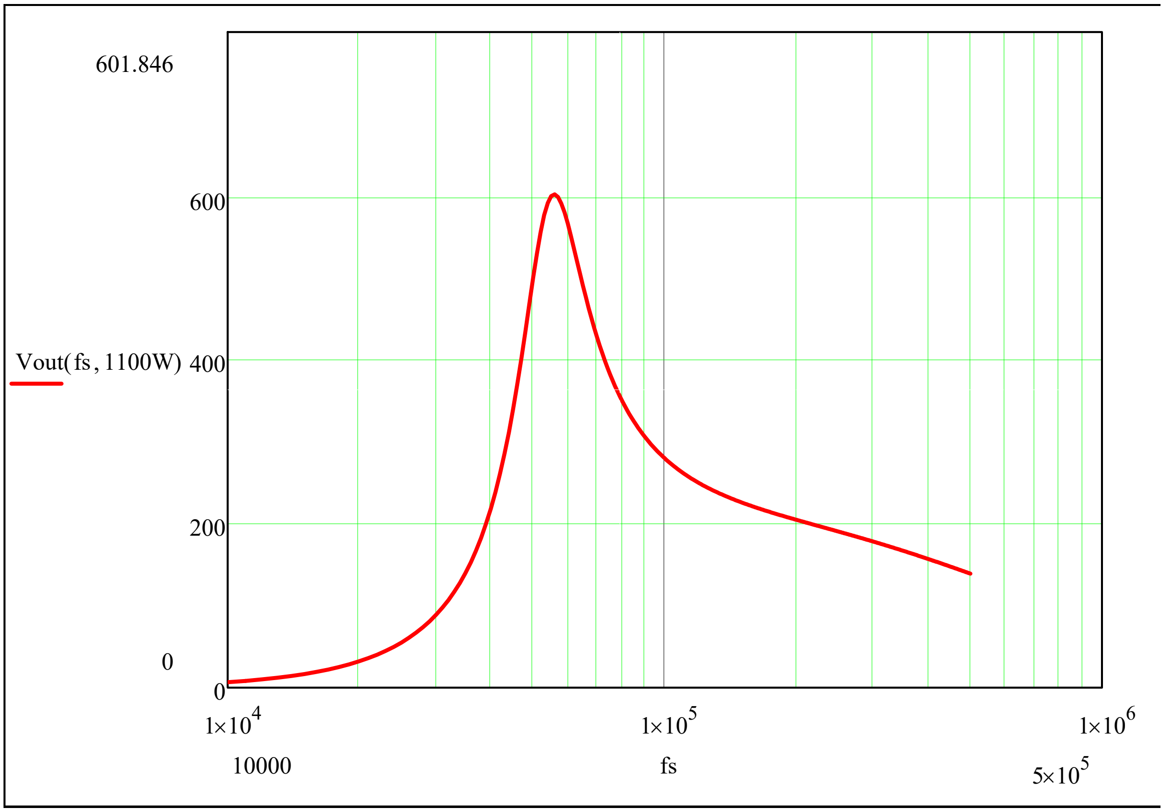
$$M(fs,Po) := \frac{0.5}{\sqrt{\left[1 + \frac{Lr}{Lm}\left[1 - \left(\frac{fr}{fs}\right)^2\right]\right]^2 + Qe(Po)^2\cdot\left(\frac{fs}{fr} - \frac{fr}{fs}\right)^2}}$$

The output voltage function is:

$$Vout(fs,Po) := \frac{Vpfc}{n}\cdot M(fs,Po) - 1V$$

where 1V is forward voltage drop on output diode, but with SR, the actually voltage drop is less than 1V

Then we can get the curve of oupput voltage vs switching frequency as follow:


601.846
600
400
200
0
0
Vout(fs, 1100W)
1×10^4
1×10^5
1×10^6
10000
fs
5×10^5