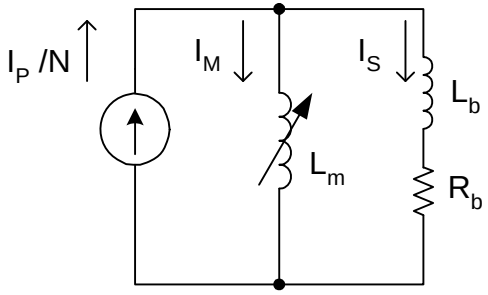
This Mathcad CT simulation is based on the paper "Computer Simulation of Current Transformers and Relays For Performance Analysis" by R.Garrett, W.C. Kotheimer, and S.E. Zocholl, presented before the 14th Annual Western Protective Relay Conference, October 20-23, 1987.

R.W. Folkers
May 7, 2003
Modified by B.K. Johnson

Current Transformer Model



$CY := 6$ Length of simulation in cycles

$I_{mag} := 21600$ RMS magnitude of CT primary current

$X := 24$ Power system inductive reactance component of X/R

$R := 2$ Power system resistance component of X/R

$R_B := 5$ Resistive burden. Reactive burden set to 20% R_B

$X_B := 0$ Reactive Burden in Ohms

$I_{rated} := 5$ CT rated secondary current

$N := 240$ CT turns ratio

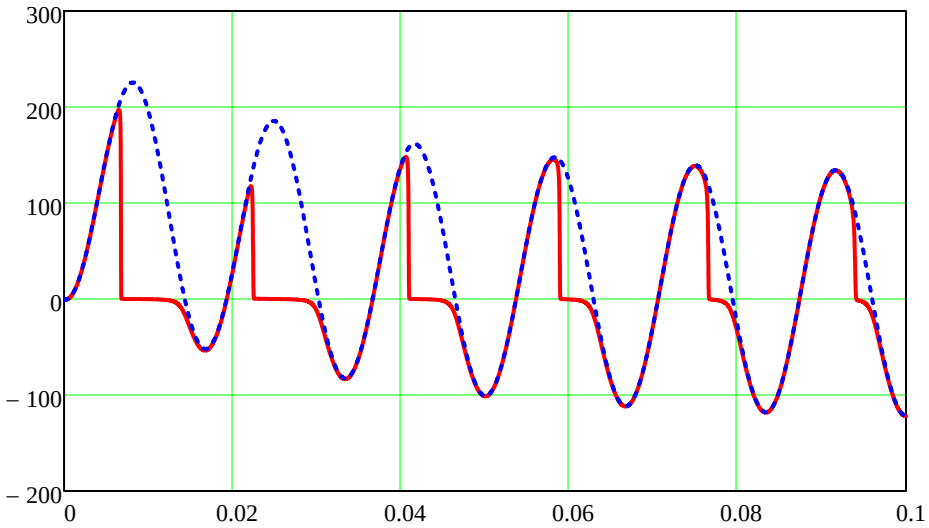
$V_{RAT} := 800$ CT "C-Rating"

$Rem := 0.$ Per Unit Remnant Flux

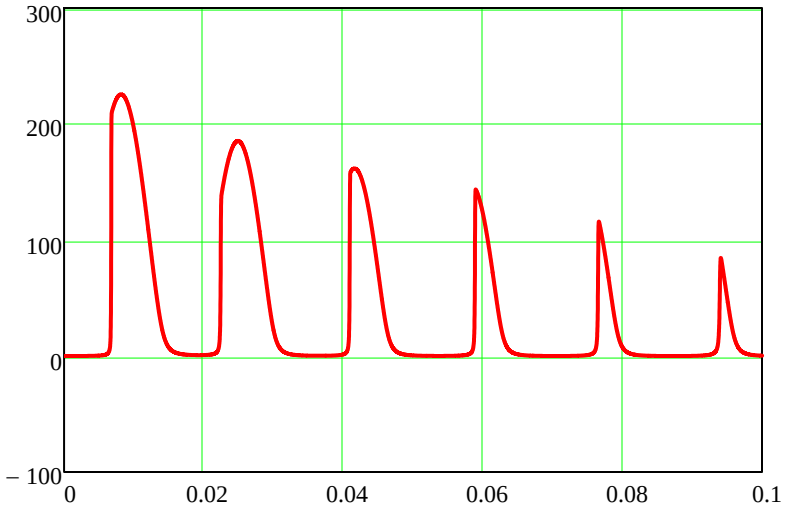
$$\left(1 + \frac{X}{R}\right) \cdot \frac{I_{mag}}{I_{rated} N} \cdot \frac{\left|R_B + j \cdot \omega \cdot L_b\right| \cdot 100}{V_{RAT}} = 146.3$$

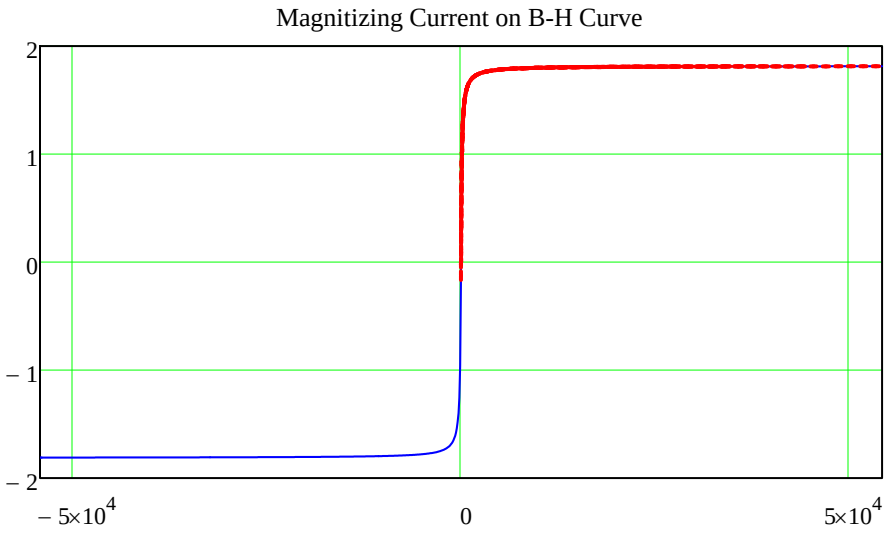
If this is less than 20, the CT satisfies criterion to avoid saturation entirely

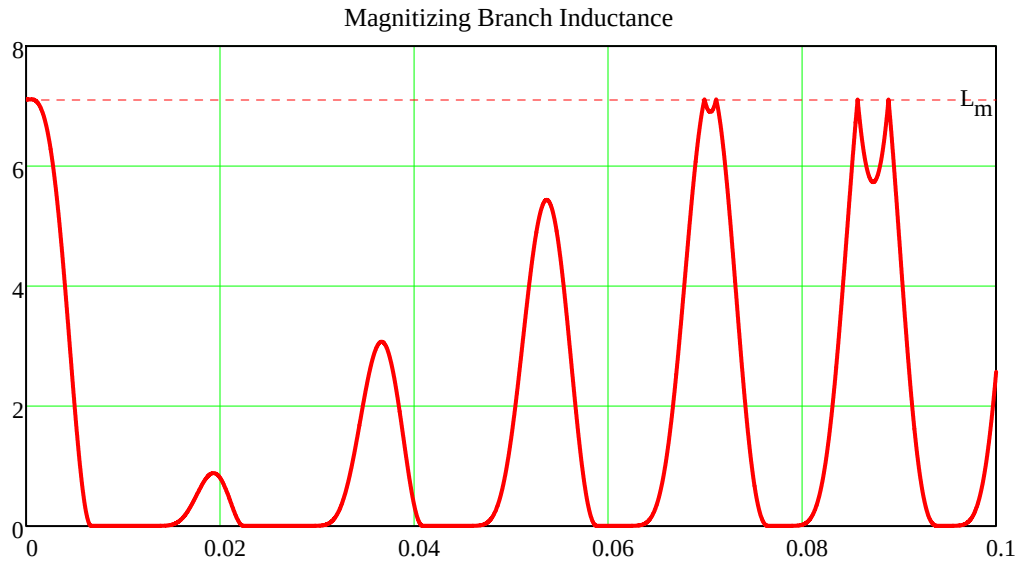
Secondary Current

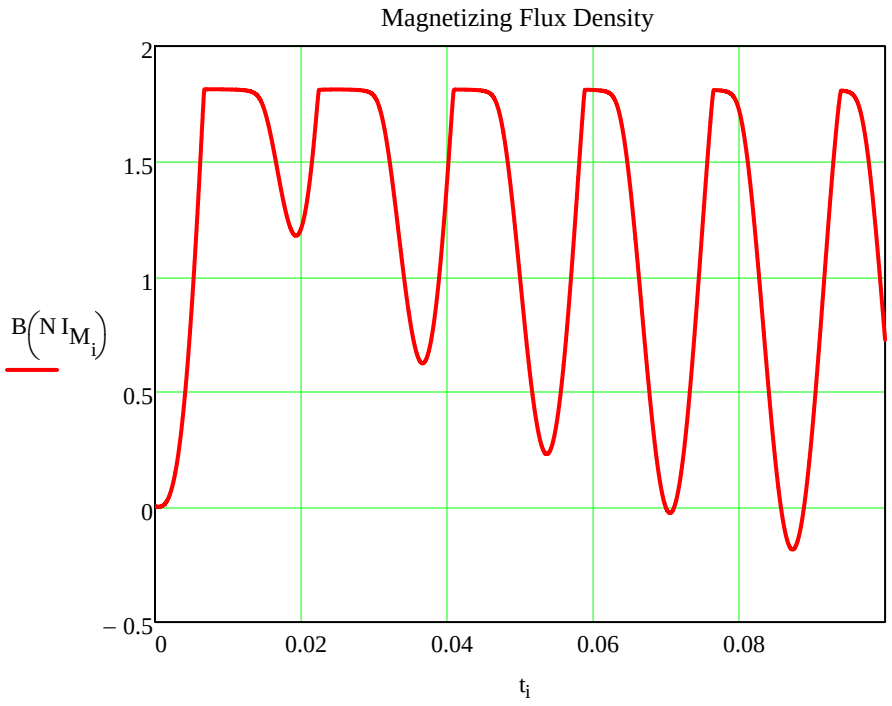


Magnitizing Current

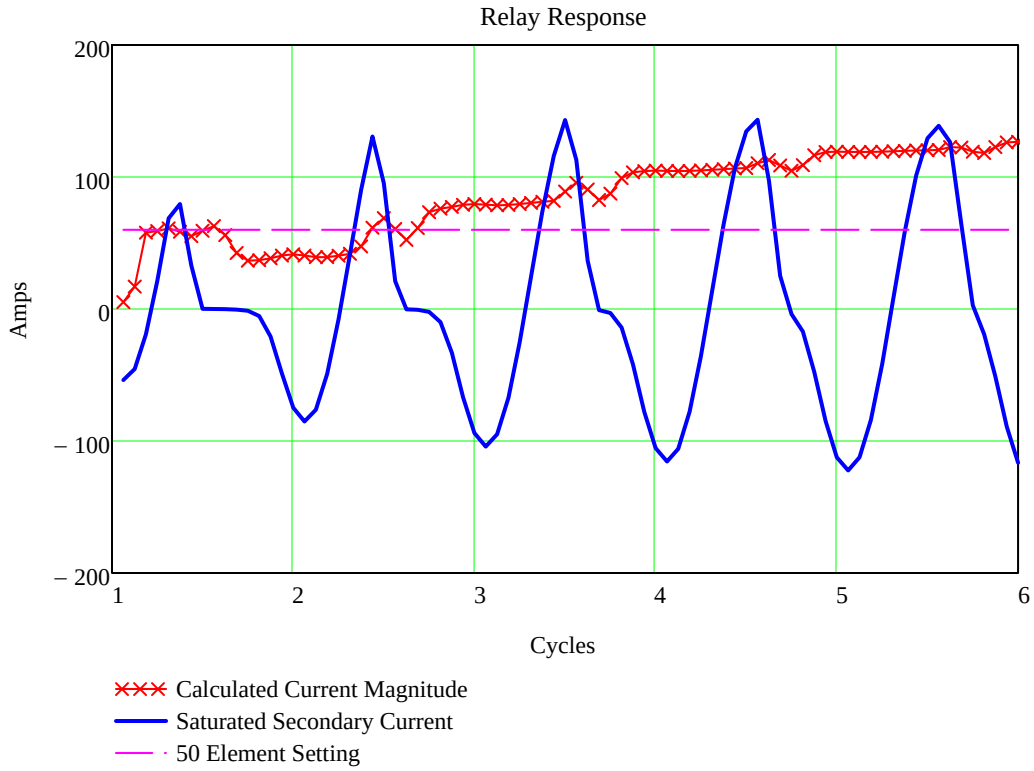



Magnitizing Current on B-H Curve
2
1
0
– 1
– 2
– 5×10^4
0
5×10^4


Magnitizing Branch Inductance
8
6
4
2
0
0
0.02
0.04
0.06
0.08
0.1
L_m



Reaches 1.8 T in 6.7ms


Relay Response
200
100
0
– 100
– 200
Amps
1
2
3
4
5
6
Cycles
Calculated Current Magnitude
Saturated Secondary Current
50 Element Setting