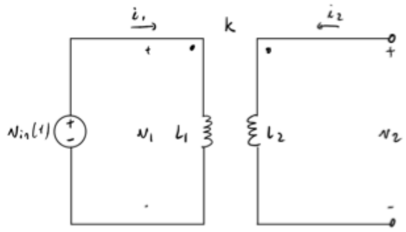
08/03/21

Heimadæmi 7 lausnir

Dæmi 1 – Gagnspan og spenna í bakvafi

Gefið er að $v_{\text{in}}(t) = 10sin(10t)$V. Finnið gagnspanið M og spennuna v_2 sem spanast upp í L_2.



Breyta	Gildi
L_1	1 mH
L_2	5 mH
k	0.7

Finnum gagnspan með $k = \frac{M}{\sqrt{L_1 L_2}}$ eða $M = k\sqrt{L_1 L_2} = \frac{7}{10}\sqrt{5}$ mH $= \frac{7}{2\sqrt{5}}$ mH $\approx$ 1.57mH

Nú er $v_1 = L_1 \frac{di_1}{dt} + M \frac{di_2}{dt}$. Tökum eftir að $i_2 = \frac{di_2}{dt} =$

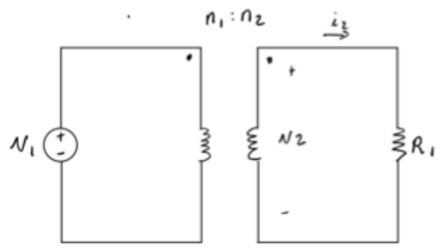
Þá er ljóst að $\frac{di_1}{dt} = \frac{v_1}{L_1}$

Á bakvafi gildir

$$v_2 = M\frac{di_1}{dt} + L\cancel{\frac{di_2}{dt}}^{\,0} = M \cdot \left(\frac{v_1}{L_1}\right) = k\frac{\sqrt{L_1 L_2}}{L_1} v_1 = \frac{7}{2\sqrt{5}\cdot 5} v_1 = \frac{7\sqrt{5}}{5}\sin(10t)\ \text{V}$$

Dæmi 2 – Kjörspennir

Höfum kjörspenni og innmerki $v_1 = sin(377t)$V. Finnið v_2, i_2 og p_2, aflið sem eyðist í R_1.



Breyta	Gildi
$n_1 : n_2$	$10 : 1$
R_1	$2\,\Omega$

Fyrir kjörspenni gildir $\boxed{\frac{v_1}{v_2} = \frac{n_1}{n_2}}$

Því er $v_2 = \frac{n_2}{n_1} v_1 = \frac{1}{10} \sin(377t)$ V

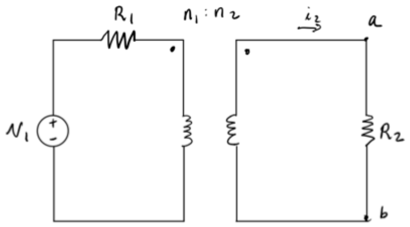
$$i_2 = \frac{v_2 - 0}{R_1} = \frac{1}{20} \sin(377t) \text{ A}$$

& $p_2 = v_2 i_2 = \left(\frac{1}{10}\sin(377t)\right)\left(\frac{1}{20}\sin(377t)\right) = \frac{1}{200}\sin^2(377t)$

$$= \frac{1}{200}\left[\frac{1}{2}\left(1 - \cos(2 \cdot 377t)\right)\right] = \frac{1}{400}\left(1 - \cos(754t)\right) \text{ W}$$

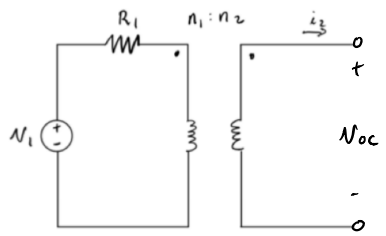
Dæmi 3 – Kjörspennir, Thévenin jafngildisrás

Finnið Thévenin jafngildisrás milli póla a og b. Hvaða hlutfall $n_1 : n_2$ hámarkar afl í R_2?



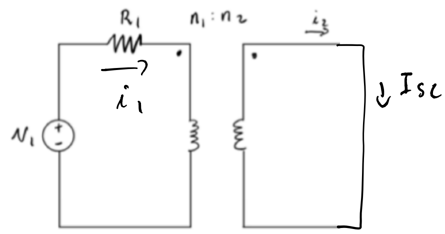
Breyta	Gildi
R_1	$800\,\Omega$
R_2	$80\,\Omega$

Fyrir kjörspenni gildir $\boxed{\frac{v_1}{v_2} = \frac{n_1}{n_2}}$



Finnum tómgangsspennu v_{oc}. Höfum $\frac{v_1}{v_{oc}} = \frac{n_1}{n_2}$

svo $v_{oc} = v_1 \frac{n_2}{n_1}$



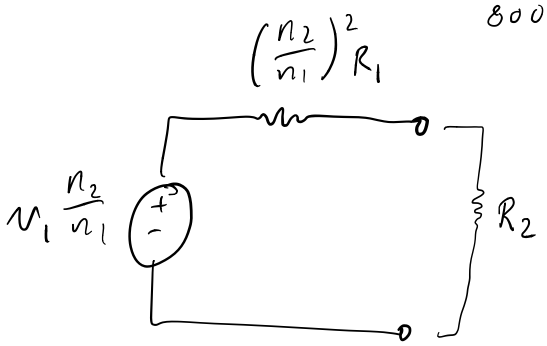
Finnum næst skammhlaupsstrauminn

Höfum $\boxed{\frac{i_1}{i_2} = +\frac{n_2}{n_1}}$ svo $i_2 = I_{sc} = \left(\frac{n_1}{n_2}\right) i_1$

en $i_1 = \frac{v_1 - 0}{R_1} = \frac{1}{800} v_1$

svo $I_{sc} = \frac{1}{800}\left(\frac{n_1}{n_2}\right) v_1$ A

Þá er $R_{Th} = \frac{v_{oc}}{I_{sc}} = \frac{v_1 \left(\frac{n_2}{n_1}\right)}{\frac{1}{800}\left(\frac{n_1}{n_2}\right) v_1} = \left(\frac{n_2}{n_1}\right)^2 R_1$

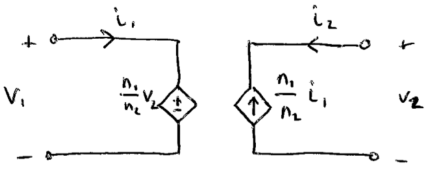


Það hlutfall $\frac{n_1}{n_2}$ sem hámarkar afl í R_2 þegar $Z_{th} = R_2$

eða $\left(\frac{n_2}{n_1}\right)^2 R_1 = R_2$ svo $\frac{n_1}{n_2} = \sqrt{\frac{R_1}{R_2}} = \frac{\sqrt{10}}{1}$

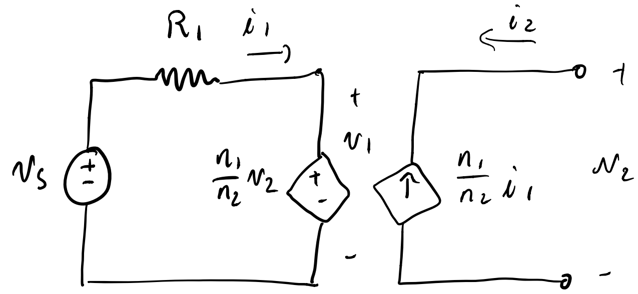
Hér er önnur aðferð við að leysa sama dæmi

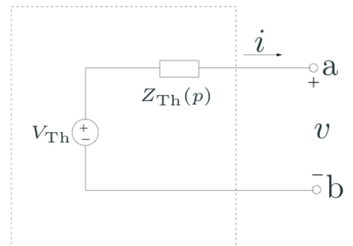
Notum módel fyrir kjörspenni



& finnum spennu milli póla a & b á formi

$$\boxed{v_2 = V_{\mathrm{Th}} - Z_{\mathrm{Th}} i}$$





Höfum $i_1 = \dfrac{v_s - v_1}{R_1}$ & $i_2 = -\dfrac{n_1}{n_2} i_1 = -\dfrac{n_1}{n_2}(v_s - v_1) G_1$

Höfum $v_1 = \dfrac{n_1}{n_2} v_2$

þá er $i_2 = -\dfrac{n_1}{n_2} G_1 \left(v_s - \dfrac{n_1}{n_2} v_2 \right)$

& $v_2 = \left(\dfrac{n_2}{n_1}\right)^2 R_1 \left(\dfrac{n_1}{n_2} G_1 v_s + i_2 \right)$

svo $v_2 = \dfrac{n_2}{n_1} v_s + \left(\dfrac{n_2}{n_1}\right)^2 R_1 i_2$

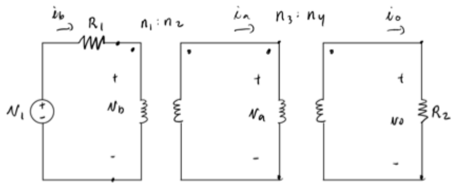
$i = -i_2$

$$v_2 = V_{th} - Z_{th}\, i$$

svo $\underline{\underline{V_{th} = \dfrac{n_2}{n_1} v_s \quad \& \quad Z_{th} = \left(\dfrac{n_2}{n_1}\right)^2 R_1}}$

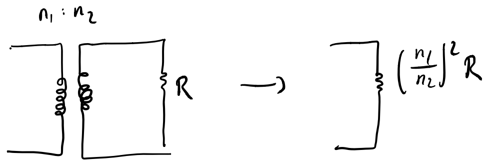
Dæmi 4 – Kjörspennar, jafngildisviðnám

Finnið jafngildisviðnámið $R_{\text{eq}} = v_b/i_b$.

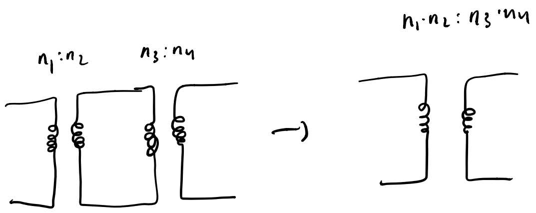


Breyta	Gildi
$n_1 : n_2$	$1 : 1.25$
$n_3 : n_4$	$1 : 4$
R_1	$10\,\Omega$
R_2	$4\,\text{k}\Omega$

Við vitum að gera má eftirfarandi einföldun



sömuleiðis



(Af hverju?)

svo $R_{eq} = \frac{v_b}{i_b} = \left(\frac{n_1}{n_2}\right)^2 \left(\frac{n_3}{n_4}\right)^2 R_2 = \left(\frac{1}{n_3 n_4}\right)^2 R_2 = \left(\frac{1}{5}\right)^2 \cdot 4\,k\Omega = \underline{\underline{160\,\Omega}}$