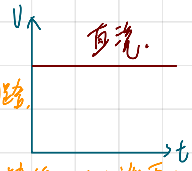
5/26(五) 考試，(工四 B26)
*可帶筆記，計算機，平板(可查資料..)，書

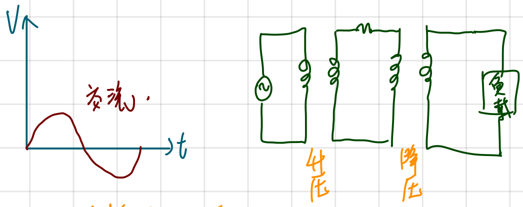
1. (10) Compare DC power system with AC power system.

直流電力系統



①∵電感短路，電容開路，∴沒有虛功.
②傳統的無法升降壓轉換；近代靠電力電子

交流電力系統



①分：單相 & 三相
②電感、電容不能忽略，⇒產生虛功.
③利用變壓器升壓⇒減少傳輸線損失再降壓提供負載使用.

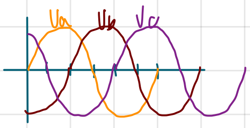
2. (10) Compare AC single phase voltage with three phase voltage.

單相：

缺點：Power脈動．
實功是擾動的

$v(t) = V_m \cdot \sin\omega t$

三相：



優點：Power是常數 $= 3 \cdot V_{相} \cdot I_{相} \cos\theta = \sqrt{3}\, V_{line\text{-}to\text{-}line} \cdot I_{line\text{-}to\text{-}line} \cos\theta$ (線對線)

$V_a(t) = V_m \cdot \sin\omega t$

$V_b(t) = V_m \cdot \sin(\omega t - 120^\circ) = V_m \sin(\omega t - \frac{2}{3}\pi)$

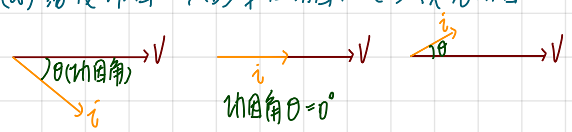
$V_c(t) = V_m \cdot \sin(\omega t - 240^\circ)$

3. (10) A generator will be paralleled with a running AC power system. Which conditions are required for paralleling?

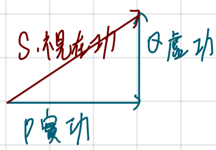
併網條件：① 頻率 (f(頻率), $\omega = 2\pi f$ (角速度)) 一樣，
② 角度一樣
③ 相序一樣
④ V_m (振幅) 一樣，

4. (10) Plotting the generator phasor diagrams under (a) lagging power factor; (b) unity power factor; (c) leading power factor.

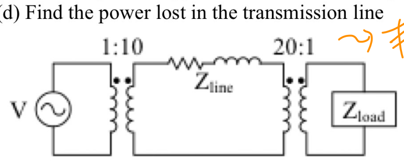
相量圖在同步座標.
(a) 落後功因，(b) 單位功因，(c) 領先功因.

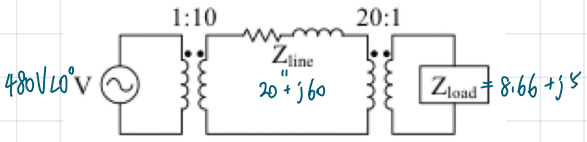


補充：



5.(20) A simple power system is shown in figure. This system contains a 480V(0°)/60Hz generator connected to an ideal 1:10 step-up transformer, a transmission line, an ideal 20:1 step-down transformer, and a load. The impedance of the transmission line is Z_{line} =20+j60Ω, and Z_{load} =8.66+j5Ω. The base values for this system are chosen to be 480V and 10kVA at the generator.
(a) Find the base voltage, current, impedance, and apparent power at every point in the power system.
(b) Convert this system to its per-unit equivalent circuit. (→ 看標么)
(c) Find the power supplied to the load in this system.
(d) Find the power lost in the transmission line → 教學網.





Q:
標么基準 480V, 10kVA.
(a) 基準(V, I, 阻抗, 視在功)
(b) 簡化成標么圖
(c) 負載的真實功率.
(d) 傳輸線損.

→ 課本有答案,
也在講義CH2. EX2-3, 有Ans.

A: 發電機. $V_b = 480$, $S_b = 10kVA \Rightarrow \frac{480}{480} = 1\angle 0°$ (標么)

傳輸線, $V_b = 4800$, $S_b = 10kVA$.

$\Rightarrow S_b = V_b \cdot I_b \Rightarrow I_b = \frac{10kVA}{4800} \Rightarrow Z_b = \frac{V_b}{I_b} = \frac{4800}{\left(\frac{10kVA}{4800}\right)}$

阻抗 $\frac{20+j60}{Z_b}$

負載 $V_b = 240$, $S_b = 10kVA \Rightarrow I_b = \frac{10kVA}{240} \Rightarrow Z_b = \frac{V_b}{I_b} = \frac{240}{\left(\frac{10kVA}{240}\right)}$

阻抗 $\frac{8.66+j5}{Z_b}$

bus2: 流進虛功 = 流出虛功.
流進實功 = 流出實功.

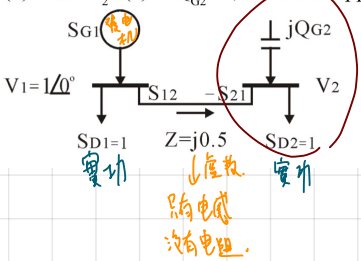
即 $P_{12} = S_{D2} = 1$

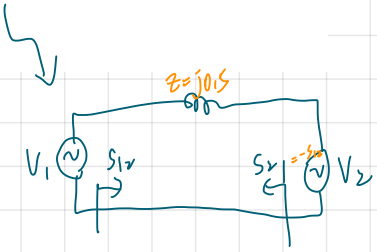
$\because P_{12} = \frac{|V_1||V_2|}{X}\sin\theta_{12}$; $Z = j0.5 = jX = j\omega L$.

已知 $\begin{cases}|V_2| = 1\\ |V_1| = 1\end{cases}$ $X = 0.5 \Rightarrow \sin\theta_{12} = 0.5$, $\theta_{12} = 30° \Rightarrow V_2 = 1\angle -30°$

6.(20) S_{G1}:V_1=1∠0°, S_{D1}=1, jQ_{G2}:V_2=?, S_{D2}=1, Z=j0.5, (a)Find Q_{G2} for $|V_2|$=1 (b) and $\angle V_2$?(c) If Q_{G2}=0, could be supplied load S_{D2} ?(d) and $\angle V_2$?

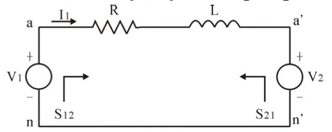
CH2 EX2.14.



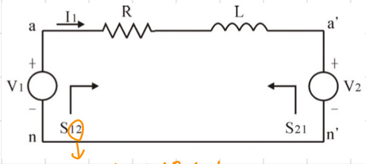


① 求 θ_{G2}, V_2 = ?
(a) $|V_2| = 1$
(b) $\angle V_2$ = ?
(c) $Q_{G2} = 0$.
(d) $\angle V_2$ = ?

7. (20) Find (a) S12 and S21; (b) P12 and –P21; (c) Q12 and Q21.
($Z=R+j\omega L$, $V_1=|V_1|e^{j\theta 1}$，$V_2=|V_2|e^{j\theta 2}$，$Z=|Z|\, e^{j\angle Z}$，$\theta_{12}=\theta_1-\theta_2$)



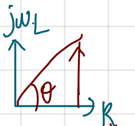
CH2 Ex 2.12



從1到2的視在功.

$S_{12} = V_1 \overset{*}{} I_1$ (*)⇒共軛. → see CH2 式(2.5).
乘

$Z = R + j\omega L$ →



$|Z| = \sqrt{R^2+(\omega L)^2}$, $\tan\theta = \frac{\omega L}{R}$.

$\Rightarrow Z = |Z| e^{j\angle\theta}$

(a) $S_{12} = V_1 I_1^*$

$S_{21} = V_2(-I_1)^*$

$I_1 = \frac{V_1 - V_2}{Z}$

$S_{12} = V_1 \cdot \left(\frac{V_1 - V_2}{Z}\right)^*$

$= V_1 \left(\frac{V_1^* - V_2^*}{Z^*}\right)$ → S12 的 ans 寫 CH2 の 式(2.26)

$S_{21} = V_2 \left(\frac{V_2 - V_1}{Z}\right)^*$

$= V_2 \left(\frac{V_2^* - V_1^*}{Z^*}\right)$ 式(2.27)

assume R=0: P_{12} & $-P_{21}$ 相等 : 式(2.31)