

上圖所示為一平衡三相電力系統之單線圖。各元件之額定容量(三相)及額定電壓(線對線)如下：

發電機： 30MVA, 13.8KV,  $X_s$  (同步電抗) = 0.1 pu

電動機： 15MVA, 13.8KV,  $X_s = 0.06$  pu

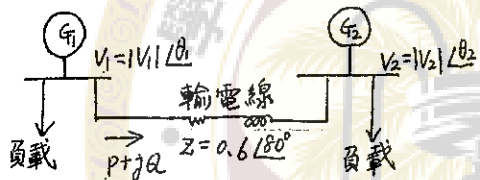
變壓器  $T_1$ ： 20MVA, 13.2 - 132KV,  $X_l$  (漏電抗) = 0.1 pu

變壓器  $T_2$ ： 15MVA, 138 - 13.8KV,  $X_l = 0.15$  pu

輸電線：  $20 + j80 \Omega$

若選擇發電機之額定容量及額定電壓為發電機側之基準值，試計算各元件阻抗之標么值，並將其標示於此系統之阻抗圖 (IMPEDANCE DIAGRAM) 上。(11%)

2.



左圖所示為一平衡三相電力系統之單線圖。

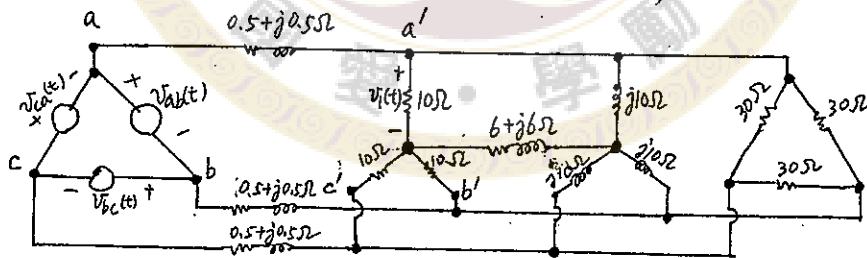
假設  $|V_1| = 1.05$ ,  $|V_2| = 1$ , 輸電線之串聯阻抗  $Z = 0.6 \angle 180^\circ$ , 其並聯電容可忽略不計。

令  $\theta_{12} \triangleq \theta_1 - \theta_2$ .

(a) 試以  $P$  為橫軸,  $Q$  為縱軸, 繪出電力圓線圖 (POWER CIRCLE DIAGRAM) ( $0 \leq \theta_{12} \leq 2\pi$ ), 並求圓心及半徑。(6%)

(b) 若  $0 \leq \theta_{12} \leq 2\pi$ ,  $P$  為最大時,  $\theta_{12} = ?$  (5%)

3.



上圖所示為一三相平衡電力系統。若  $v_{ab}(t) = 100\sqrt{2} \cos 377t$  (伏特) 時, 試求  $v_i(t)$ 。(11%)

見背面

4. 假設一磁路系統只含一繞組，其線圈匝數為 100 匝，激磁電流均方根值為 10 (安培)，磁阻 (Reluctance) 為  $10 \left( \frac{\text{安培}}{\text{韋伯}} \right)$ ，試求繞組之電感值。(20%)

5. 假設三相，110 伏，60 赫茲 (Hz) 交流感應馬達之穩態滑差率  $s = 2\%$ ，試求此馬達轉子繞組線圈感應電壓頻率值。(13%)

接次頁

6. Please use the “volt-second balance” theory to derive the voltage gain ( $V_{out}/V_{in}$ ) of the DC-DC converter shown in Fig. 1. [14%]

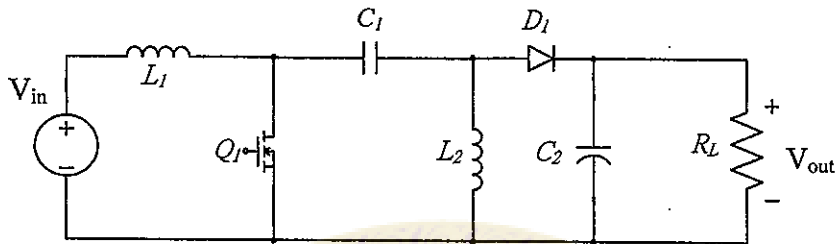


Fig. 1

7. A DC-DC step-down (buck) converter with  $V_{in}=48V$ ,  $V_{out}=12V$ , and  $P_{out}=72W$  is operated in the boundary conduction mode (BCM) at 40% load with the switching frequency  $f_{sw}=100$  kHz, assuming a very large output capacitor is used.
- (a) Please determine the inductance value,  $L$ , to meet the required BCM condition. [10%]
- (b) Based on the inductance value determined from (a), please calculate the value of maximum inductor current when the buck converter is operated at full (100%) load. [5%]
- (c) If only the desired output voltage is changed to  $V_{out}=18V$  and an inductor  $L=50\mu H$  is used, please calculate the value of maximum inductor current at full (100%) load. [5%]

試題隨卷繳回