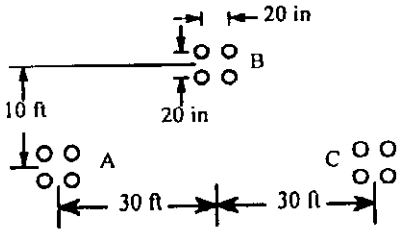
國立臺灣科技大學
八十七學年度碩士班招生考試試題

所　別：電機工程技術研究所　　組別：電力組　　科目：電力工程
學程別：

（共六題，滿分一百分）

1. Calculate the resistance, inductive reactance, capacitive reactance, and current carrying capacity of the overhead line shown in Fig. 1. The resistance and geometric mean radius (GMR) of each conductor in the bundle is 0.1204 Ω/mile and 0.0403 ft, respectively. The conductor diameter is 1.196 in. The rated current carrying capacity for each conductor in the bundle is 996 A. Neglect the effect of the ground and assume that the line operates at 60 Hz, and a conductor temperature of 75°C. (15%)



Phase Conductors: 954 kcmil ACSR 54/7

Fig. 1 Line configuration for Problem 1.

2. Two branches having impedances equal to j0.25 per unit are coupled through mutual impedance Z_m = j0.15 per unit, as shown in Fig. 2. Find the nodal admittance matrix for each of the mutually coupled branches. (15%)

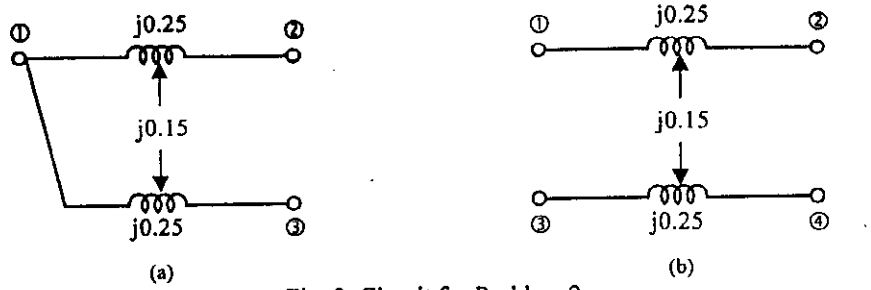


Fig. 2 Circuit for Problem 2.

3. Two synchronous machines are connected through three-phase transformers to the transmission line shown in Fig. 3. The ratings and reactances of the machines and transformers are

Machines S1 &S2:
100MVA, 20kV;
$X''_d = X^{(1)} = X^{(2)} = 20\%$
$X^{(0)} = 4\%$; $X_n = 5\%$

Transformers T1 &T2:
100MVA, 20kVΔ/345Y kV;
X = 8%

On a chosen base of 100MVA, 345 kV in the transmission-line circuit, the reactances of lines L1, L2 and L3 are $X^{(1)} = X^{(2)} = 15\%$ and $X^{(0)} = 50\%$. The system is operating at nominal voltage without prefault currents when a bolted line-to-line fault occurs at bus ③. Determine the currents in the fault. (20%)

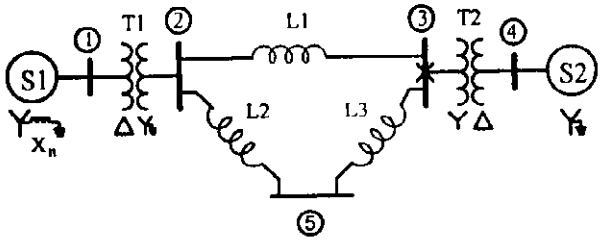


Fig. 3 Single-line diagram for Problem 3.

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4. (a) Derive the Jacobian matrix in polar form for Newton-Raphson (NR) power flow analysis. (10%)
(b) Solve the power flow analysis for the system as shown in Fig. 4 by NR method for one iteration. (15%)

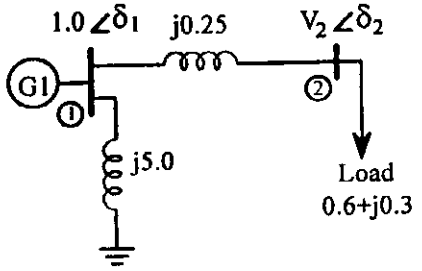

Fig. 4 Single-line diagram for Problem 4.

5. Table 1 shows the three unit system data. Find the system incremental fuel cost and the required output of each unit for economic dispatch if the total generation is 550 MW and the power loss $P_{Loss} = 0.05PG_1 + 0.03PG_3$. (15%)

Unit	Fuel Cost ($/hr)	PG_{max}	PG_{min}
1	$0.001PG^2 + 2PG + 29$	200	50
2	$0.002PG^2 + 2PG + 29$	250	150
3	$0.003PG^2 + 1.5PG + 30$	200	50

6. When a generator delivers power to the infinite bus through a transmission line with impedance x, write the power swing equation for the generator and describe the frequency response when a three phase short circuit occurs at the infinite bus for 5 cycles. (10%)