

# 國立臺北科技大學

107 學年第二學期電機系博士班資格考試

## 交流電機控制試題

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### 注意事項：

1. 本試題共【3】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間：二小時。
5. 可以使用計算器作答。

1. Consider a three-phase induction motor, Y connection, sequential  $a$ - $b$ - $c$  in phase; line stator current  $i_{as} = 10\cos(100t)$  A,  $i_{bs} = 10\cos(100t)$  A,  $i_{cs} = 10\cos(100t)$  A, Calculate the  $d$ ,  $q$  currents ( $i_q - j i_d$ ) in stationary and synchronous frames: (35%)

(a)  $i_{qs}^s, i_{ds}^s = ?$  (b)  $i_{qs}^e, i_{ds}^e = ?$

{ Hint:  $i_{qds}^s = i_{qs}^s - j i_{ds}^s = \frac{2}{3}(i_{as} + a i_{bs} + a^2 i_{cs})$  ;  $a = 1 \angle \frac{2\pi}{3}$  ;

$i_{qds}^e = i_{qs}^e - j i_{ds}^e = i_{qds}^s e^{-j\omega t}$  }

2. Explain the control techniques of indirect rotor vector control for a three-phase induction motor. Some referred equations in the steady-state are shown in the following. (35%)

$$\tilde{\phi}_{qr}^e = \frac{R_r L_m}{\Delta} \left( -\frac{R_r}{L_r} \tilde{i}_{qs}^e + \tilde{\omega}_{sl} \tilde{i}_{ds}^e \right), \quad \tilde{\phi}_{dr}^e = \frac{R_r L_m}{\Delta} \left( -\frac{R_r}{L_r} \tilde{i}_{ds}^e - \tilde{\omega}_{sl} \tilde{i}_{qs}^e \right),$$

$$\Delta = \left( \frac{R_r}{L_r} \right)^2 + (\tilde{\omega}_{sl})^2, \quad T_e = \frac{3}{2} \frac{P}{2} \frac{L_m}{L_r} (i_{qs}^e \phi_{dr}^e - i_{ds}^e \phi_{qr}^e)$$

3. Explain the differences of the control techniques between vector control and direct torque control for the control of a three-phase induction motor.  
(30%)