國立臺北科技大學

九十七學年第二學期電機系博士班資格考試

變頻器試題

注意事項：

1. 本試題共【6】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。

1. Fig. 1 shows the block diagram of vector-controlled induction motor drives. Please highlight the error in Fig. 1. (20%)
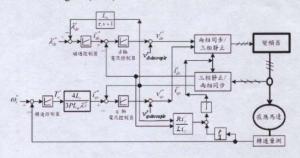

Fig. 1 Block diagram of vector-controlled induction motor drives

2. Given the sampled modulating signals at two consecutive time sampled instants are $M\sin(\omega t_k)$ and $M\sin(\omega t_{k+1})$, and the triangular carrier period is T, Please derive the related pulse width for PWM control. (15%)

3. What is two-phase modulation PWM? (5%) What is Universal Space Vector Modulation? (10%)

4. Draw the waveforms of common-mode voltage for three-phase inverter for the switching

states (100), (110) and (000). (10%) (Assuming the DC link voltage = V_{DC})

5. Illustrate two methods for reducing or blocking the bearing current for three-phase inverter-controller induction motor drives. (10%) And show how these methods can achieve that. (10%)

6. For the induction motor model shown in the equation:

$$\bar{v}_s^e = \bar{i}_s^e R_s + j\omega\bar{\lambda}_s^e + p\bar{\lambda}_s^e$$
$$0 = \bar{i}_r^e R_r + j(\omega - \omega_r)\bar{\lambda}_r^e + p\bar{\lambda}_r^e \quad \text{and with rotor flux oriented control}$$
$$\bar{\lambda}_s^e = L_s\bar{i}_s^e + L_m\bar{i}_r^e$$
$$\bar{\lambda}_r^e = L_m\bar{i}_s^e + L_r\bar{i}_r^e$$

    Derive the (1). **Slip frequency**, and (2). **Voltage model** of the flux estimator (20%).