國立臺北科技大學

九十八學年度研究所碩士在職專班入學考試

能源與冷凍空調工程系碩士班

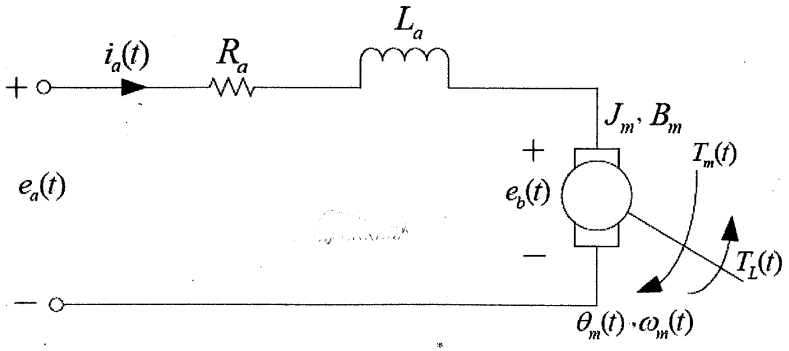
乙組：自動控制試題

填准考證號碼　　第 1 頁　共 1 頁

注意事項：

1. 本試題共【5】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。

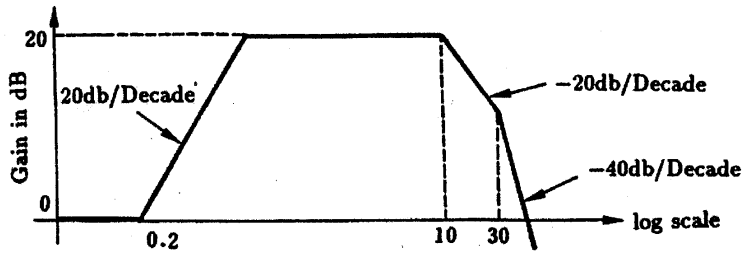
1. The equivalent circuits of a DC motor can be illustrated as the following figure. Where $e_a(t)$ is the input voltage, $i_a(t)$ is the current, R_a is the circuits resistance, L_a is the inductance, J_m is the rotor inertia, B_m is the friction loss coefficient, $\theta_m(t)$ is the angular displacement and $\omega_m(t)$ is the angular velocity.
$T_m(t)$ is the torque output from the motor and $T_L(t)$ is the driving load.
If the following two relations are known
$T_m(t) = K_i i_a(t)$
$e_b(t) = K_b \omega_m(t)$
And assuming $T_L(t)$ tends to zero.
Derive the state equations of this system with state variables, $i_a(t)$ and $\omega_m(t)$. (20 pts)



2. Use Routh's stability criterion to determine how many roots with negative real parts for the following equation:
$G(S) = S^6 + S^5 + 5S^4 + S^3 + 2S^2 - 2S - 8$ (20 pts)

3. For a single input signal output (SISO) system: $y'''(t) + y''(t) + 6y'(t) + (K-3)y(t) = u(t)$, determine the value range of K to keep this system stable. (20 pts)

4. Determine the system transfer function by the following Bode Gain Plot. (20 pts)



5. If we have a parallel water pipe system, instead of the throttle valve, we can adjust the flow rate using inverter-controlled induction motor drives. Can this methodology make the system more energy efficient? If yes, indicate the energy saving amount by the pump characteristic and system resistance curves. If no, you can illustrate the reason and explain more details on the Q-H diagram of plant. (20 pts)