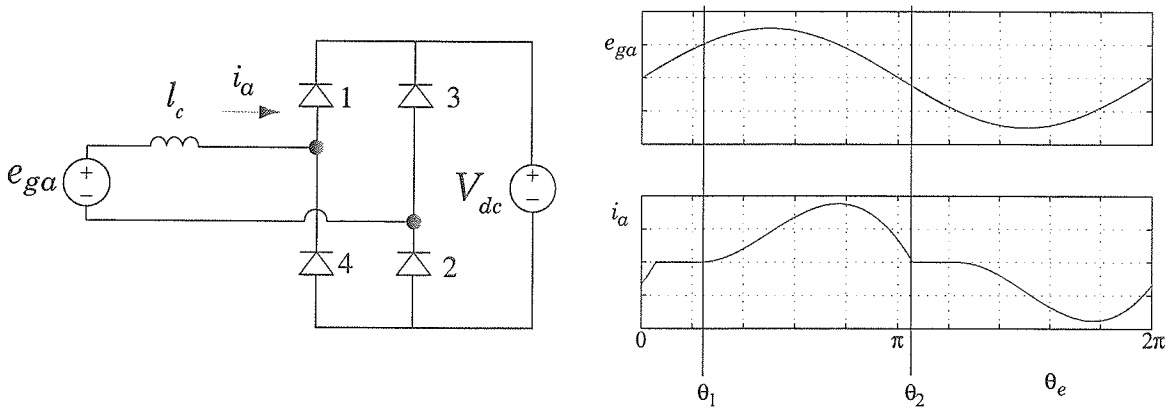
(32) 1. Consider the single-phase full-bridge thyristor-controlled rectifier.

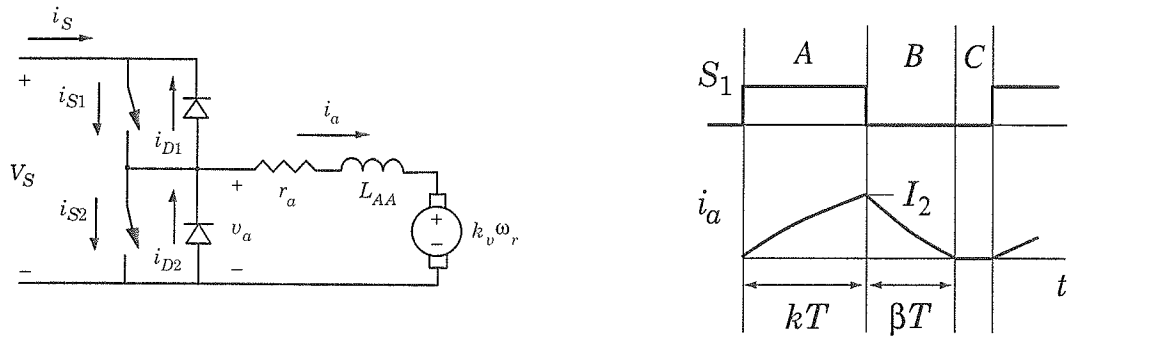


Let $e_{ga} = E\sin\theta_e$ where $\theta_e = \omega_e t$.

(a) Establish an expression for θ_1 (beginning of conduction interval for diodes 1 and 2) in terms of E and V_{dc}.

(b) Establish an expression for $i_a(\theta_e)$ over the interval $\theta_1 < \theta_e < \theta_2$.

(36) 2. Consider a dc motor supplied by a 2-quadrant chopper.



All expressions should be in terms of r_a, $\tau_a = L_{AA}/r_a$, k_v, V_S, k, T, and ω_r. You do not need to provide detailed derivations.

(a) Express $i_a(t)$ in interval A, i.e. $i_a = ?e^{?t} + \frac{?}{?}(1 - e^{?t})$. Express I_2.

(b) Sketch v_a for one period indicating its value in each interval. Express its average (expression may include β.

(c) Express $i_a(t)$ in interval B assuming $t = 0$ at beginning of interval B, i.e.

$i_a = ?e^{?t} + \frac{?}{?}(1 - e^{?t})$. Express β (expression may include I_2).

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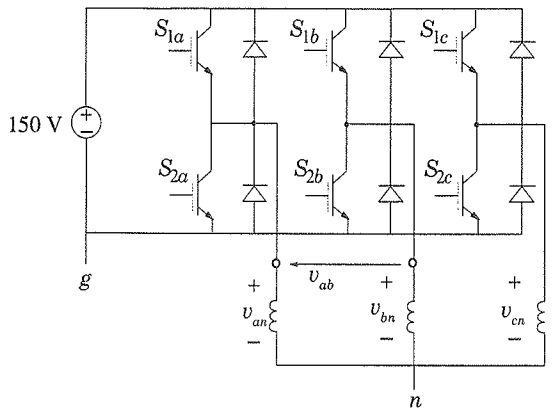

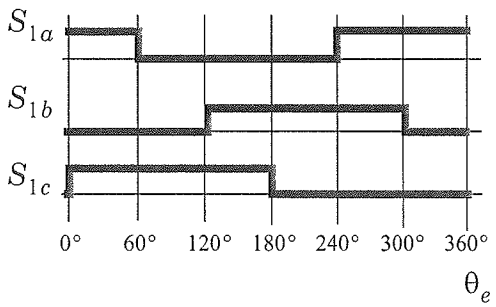

The upper (lower) switch of each phase leg is closed (open) for 180° and open (closed) for the other 180°. The switching of each phase leg is displaced ±120° relative to the other phase legs as shown above.

(a) Sketch v_{ng} (voltage from node n to node g), v_{an}, and v_{ab} indicating their values for each of the six intervals.

(b) Express the fundamental component of v_{ab} in the form $v_{ab}^{(1)} = ?\cos\theta_e + ?\sin\theta_e$ (expression may include π, $\sqrt{2}$, $\sqrt{3}$, ...).

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