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Full PDF PackageDownload Full PDF PackageThis PaperA short summary of this paper28 Full PDFs related to this paperDownloadPDF Pack After reading this topic Armature controlled DC Servomotor in the control system, you will understand the theory, derivation, expressions, transfer function, and Block diagram. Let us consider the Armature controlled DC servomotor as shown in Figure 1. The parameters are taken as $\$ \{ R, a \} \$$ = Armature winding resistance, $\$ \{ L, a \} \$$ = Armature winding inductance, $\$ \{ i, a \} \$$ = Armature current, $\$ \{ f \} \$$ = Field current, $\$ \{ e, a \} \$$ = applied armature (control) voltage, $\$ \{ e, b \} \$$ = Motor back emf, $\$ \{ T, m \} \$$ = torque developed by motor, $\$ \{ \theta \} \$$ = Angular displacement of motor shaft, $\$ \{ J \} \$$ = Equivalent moment of inertia of load and motor referred to motor shaft, $\$ \{ f \} \$$ = Equivalent viscous friction coefficient of motor and load referred to motor shaft. Transfer Function of Armature Controlled DC Motor: The speed of DC motor is directly proportional to armature voltage and inversely proportional to flux in field winding. In armature controlled DC motor the desired speed is obtained by varying the armature voltage. This speed control system is an electro-mechanical control system. We will discuss transfer function of armature controlled dc motor. The electrical system consists of the armature and the field circuit but for analysis purpose, only the armature circuit is considered because the field is excited by a constant voltage. The mechanical system consist of the rotating part of the motor and load connected to the shaft of the motor. The armature controlled DC motor speed control system is shown in the below figure. The torque developed by motor is directly proportional to armature current. The mechanical system of motor is shown in the below figure. The differential equation governing the mechanical system of motor is given by. The back emf of DC machine is proportional to speed (angular velocity) of shaft. Must Read: What is Control Systems and Types of Control systems The Laplace transform of various time domain signals involved in this system are shown below. $L\{v_a\} = V_a(s)$; $L\{eb\} = E_b(s)$; $L\{T\} = T(s)$; $L\{ia\} = i_a(s)$; $L\{\theta\} = \theta(s)$. The differential equations governing the armature controlled DC motor speed control system are On taking Laplace transform of the above equations with zero initial conditions we get, $i_a(s)Ra + La s i_a(s) + E_b(s) = V_a(s)$ $=> (1) \quad T(s) = K_t i_a(s) \quad => (2) \quad J s \theta(s) + B s \theta(s) = T(s) \quad => (3) \quad E_b(s) = K_b s \theta(s) \quad => (4) \quad \text{On equating the above equations (2),(3) we get} \quad => (5) \quad \text{Equation (1) can be written as,}$ $(Ra + sLa) i_a(s) + E_b(s) = V_a(s) \quad => (6) \quad \text{Substituting for } E_b(s) \text{ & } i_a(s) \text{ from (4),(5) respectively in equation (6) The required transfer function of armature controlled dc motor is } \theta(s)/V_a(s) \quad => (7) \quad \text{Must Read: Examples of Open & Closed Loop Control Systems The transfer function of armature controlled dc motor can be expressed in another standard form as shown below. From the equation (7) we get, where } La/Ra = T = \text{Electrical time constant} \quad JB = T_m = \text{Mechanical time constant Conclusion:} \quad \text{In this post we have learnt about, transfer function of armature controlled DC motor. You can download this article as pdf, ppt. Comment below if you have something to say!}$

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