The Gentpj Model

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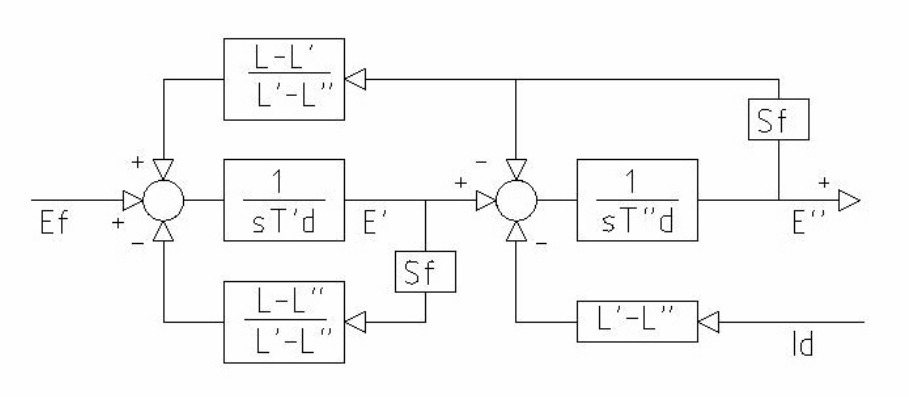
1 The Form of the Model

The gentpj generator model is an extension of the gentpf model. Gentpf, in turn, is the type F model of the WSCC Staff stability program. The structure of the generator model is described in reference (1). The associated linkage of generator models to the transmission network, as used in the PSLF and PSS/E programs, is described in reference (2).

The detailed equations used in gentpf and gentpj are given by (1) through (20). With the parameter Kis set to zero in (1.19) the gentpj model is identical to gentpf. The saturation function appearing in (1.19) is the open circuit magnetization curve. Equations (1)-(20) correspond to the transfer function diagram shown below.



This diagram is indicative but, because of the nonlinear nature of (1)-(20), should not be used as a basis for implementing the model; implementation requires direct use of the full set of equations.

2 References

1. D. W. Olive, "Digital Simulation of Synchronous Machine Transients" IEEE Transactions, Vol PAS-87, pp1669-1675, 1968

2. J. M. Undrill, "Structure in the Computation of Power System Nonlinear Dynamical Response", IEEE Transactions, Vol PAS-88, pp1-5, 1969

3 Equations

$$V_q = E_{q1} + E_{q2} - I_q R_a - I_d X_{ds} \tag{1}$$

$$V_d = E_{d1} + E_{d2} - I_d R_a + I_q X_{qs} \tag{2}$$

$$E"_q = E_{q1} + E_{q2} - I_d X_{ddds} \tag{3}$$

$$E"_d = E_{d1} + E_{d2} + I_q X_{qqqs} \tag{4}$$

$$E'_q = E_{q1} + E_{q2} - ((X'_d - X"_d)/(X_d - X"d))E_{q2} - I_d X_{dds} \tag{5}$$

$$E'_d = E_{d1} + E_{d2} - ((X'_q - X"_q)/(X_q - X"q))E_{d2} + I_q X_{qqs} \tag{6}$$

$$dE"_q/dt = -(1 + S_d)(((X'_d - X"_d)/(X_d - X"_d))E_{q2})/T"_{do} \tag{7}$$

$$dE"_d/dt = -(1 + S_q)(((X'_q - X"_q)/(X_q - X"_q))E_{d2})/T"_{qo} \tag{8}$$

$$dE'_q/dt = (E_{fd} - (1 + S_d)E_{q1})/T'_{do} \tag{9}$$

$$dE'_d/dt = -(1 + S_q)E_{d1}/T'_{qo} \tag{10}$$

$$X_{ds} = ((X_d - X_l)/(1 + S_d)) + X_l \tag{11}$$

$$X_{dds} = (X_d - X'_d)/(1 + S_d) \tag{12}$$

$$X_{ddds} = (X_d - X"d)/(1 + S_d) \tag{13}$$

$$X_{qs} = ((X_q - X_l)/(1 + S_q)) + X_l \tag{14}$$

$$X_{qqs} = (X_q - X'_q)/(1 + S_q) \tag{15}$$

$$X_{qqqs} = (X_q - X"q)/(1 + S_q) \tag{16}$$

$$E_l = sqrt((V_q + I_q R_a + I_d X_l)^2 + (V_d + I_d R_a - I_q X_l)^2) \tag{17}$$

$$I = sqrt(I_d^2 + I_q^2) \tag{18}$$

$$S_d = (saturationfunction)(E_l + K_{is} I) \tag{19}$$

$$S_q = (X_q/X_d)S_d \tag{20}$$

4 Corrections

Equations (17) and (19) have been corrected in the revision of 19 June 2012.