Flywheel Spinup Dynamic Model

Parameters:

Wo motor free speed
Ts motor stall torque
J  flywheel inertia
G  gearbox speed reduction
Kf gearbox efficiency fraction
Ks speed-dependent torque loss

Variables:

Tf torque at flywheel
Tm motor torque
Wm motor speed
Wf flywheel speed

Equations:

Wm = G*Wf
Tm = Ts*(1-Wm/Wo)
Tf = Kf*G*Tm - Ks*Wm
d(Wf)/dt = Tf/J

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(%i1) Wm: G*Wf;
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$$(\%o1)\quad Wf\ G$$

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(%i2) Tm: Ts*(1-Wm/Wo);
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$$(\%o2)\quad Ts\left(1-\frac{Wf\ G}{Wo}\right)$$

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(%i3) Tf: Kf*G*Tm - Ks*Wm;
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$$(\%o3)\quad Kf\ Ts\ G\left(1-\frac{Wf\ G}{Wo}\right)-Ks\ Wf\ G$$

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(%i4) dWfdt = Tf/J;
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$$(\%o4)\quad dWfdt=\frac{Kf\ Ts\ G\left(1-\frac{Wf\ G}{Wo}\right)-Ks\ Wf\ G}{J}$$