6 concl'd $\therefore\ m = 2\pi\tilde{\sigma}/k t_0 = 2\pi\times 20/32.5\times 5\ \frac{\text{Ns}^2}{\text{kgm}} = 0.773$

$\qquad\qquad\qquad\qquad\qquad\qquad \text{kgm}^2\ \frac{1}{\text{Nms}}\ \frac{1}{\text{s}}$

$\therefore\ \tilde{T}_M = \frac{\tilde{T}_L}{\sqrt{1+m^2}} = \frac{100}{\sqrt{1+.773^2}} = 79.1$ Nm

The motor torque thus varies between 110 ± 79.1 Nm.

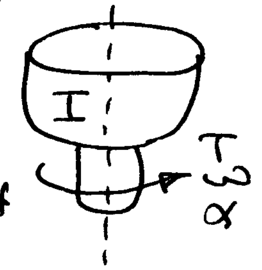
$\therefore\ T_e = \sqrt{(110^2 + 79.1^2/2)} = 123$ Nm $\approx T_f = 120$ Nm

Thus the proposal seems feasible – barely.

The acceleration time is found to be 13 s on no-load – which is O.K. for this motor.

Despite the findings of this analysis, the case is not really proven. Motor rating is after all a thermal consideration, and as noted, an exponent of 5 reflects this more realistically than does 2. Also the linearisation of the motor characteristic is rather simplistic. So this would probably be referred to motor manufacturers.

7 At start-up the motor accelerates quickly ($\Delta t <$ 1s) to full speed and thereafter runs at full load while the drum is accelerating (i.e. for 30 s). Once the drum is up to its full speed then the motor is effectively off-loaded. Assume motor full speed is about 1425 rpm. The full speed of the drum after acceleration is then $(1425/70)\times 0.96 = 19.5$ rpm assuming the coupling runs at 4% slip after settling down.



Since the torque exerted by the motor is constant (full load), and since the torque across the coupling is essentially constant (i.e. its inertia is small) then the torque T on the drum and its angular acceleration are both constant too:

$$T = I\alpha = I\frac{\Delta\omega}{\Delta t}$$

$$= \underset{\text{kgm}^2}{10\times 10^3} \times \underset{\text{rad/s}}{\frac{2\pi\times 19.5}{60}} \times \underset{1/\text{s}}{\frac{1}{30}} \times \underset{\text{Ns}^2/\text{kgm}}{1} = \underset{\text{Nm}}{682}$$

This torque is required on drum shaft to achieve acceleration in 30 s. The corresponding motor torque required is

$T_0 = 682/(70\times 0.75) = 13.0$ Nm

But this torque is not produced continuously by the motor – only whilst the