From (7): $F_0 = (\hat{F} + \lambda \check{F})/(1+\lambda)$; $0.66 \le \lambda \le 0.8$
$= (1987 + 529\lambda)/(1+\lambda)$ here.

ie. $1340 \le F_0 \le 1405$ — take $F_0 = 1370$ N as the no-load tension. The corr. radial force on shaft $F_R' = 2 \times 1370 \cos 9° = 2700$ N.
Using (7) again, or linearly interpolating, the belt tensions at 14 kW are:

$\hat{F} = 1370 + \frac{14}{28}(1987 - 1370) = 1680$ N

$\check{F} = 1370 - \frac{14}{28}(1370 - 529) = 950$ N

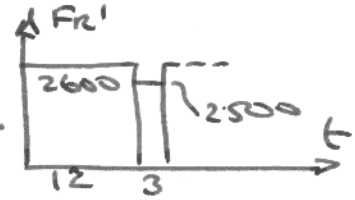
[check: $P = (\hat{F} - \check{F})v = 730 \times 19.2 = 14.0$ kW ✓]
and resolving tensions as before, the radial load is found to be $F_R' = 2600$ N.

MOTOR BEARING FATIGUE

We now have a complete loading history of shaft load F_R':

demand, kW	0	14	28
time	0	4/5	1/5
F_R', N	2700	2600	2500

We could carry out Miner's analysis, or work out equivalent F_R', but there's so little variation it's hardly worth it.



Take conservatively $F_R' = 2600$ N.
This is greater than 2230 N above for 25 kh and corr. to a life of

$$25 \times (2230/2600)^{2.5} = 17 \text{ kh}$$

However the picture's a bit rosier than this. Consulting the ABB catalogue with respect to load position on shaft, we find the load at $x = 20$ mm to be

$$F_R = 2230 / \left(1 - \frac{110 - 20}{575}\right) = 2640 \text{ N @ 25kh}$$

Since F_R' (2600) < F_R (2640) the life is achieved and so the solution's OK.

Quite a job!! Luckily in practice loads are usually constant! You can see now why it's important to establish belt model which acknowledges part load realistically.