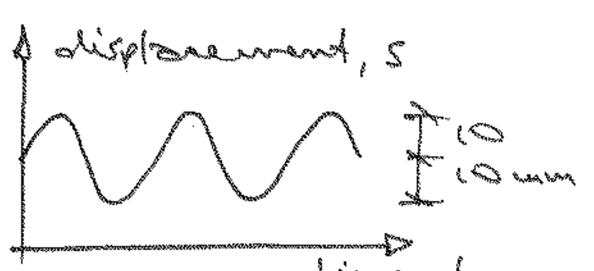
Displacement s of mass m



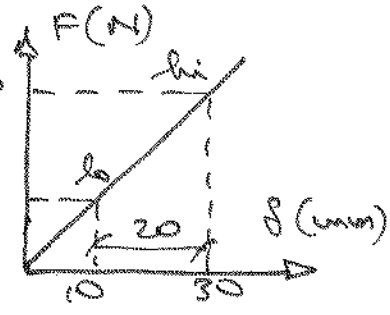
$s = \bar{s} + r \sin \omega t$; $r = 10$ mm

∴ $\hat{\ddot{s}} = \omega^2 r$ and so maximum force which has to be exerted by return spring on follower

$F_{foll.} = m \omega^2 r$

$= 9 \,(2\pi \times 10)^2 \times 0.01 = \underline{355}$ N

(kg, $\frac{1}{s^2}$, m)



We'll choose a larger value say 450 N so that we've got a safety factor dynamically. Select $F_{lo} = \frac{1}{3} F_{hi}$, which results in desired characteristic :-

$k = 300/20 = 15$ N/mm

Assume a strength safety factor of 1.1

Using the fatigue expression (5b) for music wire, e.g. with C = 5 :

$F_e = 600(5+0.5)/0.50 + 300 \times 5 \frac{5.6}{4.73}/0.15$

trial C say	(5)	(7.5)	10
which gives F_e (kN)	19.5	27.4	35.3
hence min. $F_{ult} = 1.1 F_e$	21.5	30.1	38.8
so, from Table, necessary d:	4	5	??>5
Actual n :	$\frac{21.7}{19.5} = 1.1$	$\frac{32.3}{27.4} = 1.2$	—
$n_a = Gd/8kC^3$ (note large n_a w/ small C)	$\frac{79 \times 4}{8 \times 15 \times 5^3}$ = 21	$\frac{79 \times 5}{8 \times 15 \times 7.5^3}$ = 7.8 ($7\frac{3}{4}$)	
n_T Table 1 (ends 5+6)	23	$9\frac{3}{4}$	
$L_S = n_T d$ (mm)	92	48.8	
δ_S = say $1.1\,\delta_{hi}$	33	33	
$L_0 = L_S + \delta_S$ (mm)	125	82	
BUCKLING. say ends guided $\lambda = 0.5$			
$\lambda L_0 / C_2 D$	1.19	0.42 < 1	
δ_c (32). (mm)	$46 > \hat{\delta}$	no buckling possible	
	OK.	OK	
RESONANCE TENDENCY. from (6)			
f_n (Hz)	170	164	
$f_n / f_{running}$	12 < 17.0	16.4 > 12	
	OK	OK	

Both trial solutions are feasible, as will be intermediate candidates. Further evaluation would be based on cost, space saving &c.