

TEMAT ZADANIA Z KURSU *DYNAMIKA BUDOWLI*

„ROZWIĄZANIE ZAGADNIENIA WŁASNEGO DYSKRETNEGO UKŁADU DYNAMICZNEGO”

dla.....

Dla danego schematu dynamicznego przyjąć na podstawie statycznego działania mas przekrój, jednakowy dla wszystkich prętów, składający się z dwóch kształtowników walcowanych (ceowniki). Następnie sformułować macierzowe równanie ruchu, danego układu dynamicznego i przedstawić je w postaci symbolicznej. Zaprezentować równanie drgań własnych i rozwiązać zagadnienie własne – rezultaty podać liczbowo po podstawieniu stosownych wartości. Sporządzić rysunki form własnych układu.

Opracowanie powinno zawierać:

- wszystkie niezbędne do wykonania obliczeń schematy statyczne, dynamiczne, a także szkice, itp.,
- dobór współrzędnych uogólnionych i sformułowanie macierzowego równania ruchu,
- rozwiązanie zagadnienia statycznego i dobór kształtowników walcowanych,
- rozwiązanie zagadnienia własnego, w tym wyznaczenie częstości i wektorów własnych, rysunki form własnych.

Do sformułowania macierzowego równania ruchu należy zastosować metodę przemieszczeń lub sił (dowolnie). W obliczeniach należy **pomiąć masę własną konstrukcji**. Do obliczeń należy przyjąć następujące dane liczbowe:

- wytrzymałość obliczeniowa $f_d = 215$ MPa, moduł sprężystości $E = 205$ GPa
- współczynnik obciążenia $\gamma_f = 1,2$,
- przyspieszenie ziemskie $g = 9,81$ m/s².

Termin oddania **18.06.2023 r.**, prowadzący dr inż. Krzysztof Majcher

Numer albumu przypisany jest do tematu zgodnie z poniższą tabelą.

Numer Albumu	Numer tematu
276971	1
251939	4
248254	7
248371	10
276975	13
210797	16
234366	19
244643	22
211425	25
202087	28
233421	31
169557	34
251020	37
244470	40
248350	43
242223	46
234269	49
248367	52
252003	55
251344	58
276976	61
252241	64
244641	67
276974	70
219877	73
252119	76

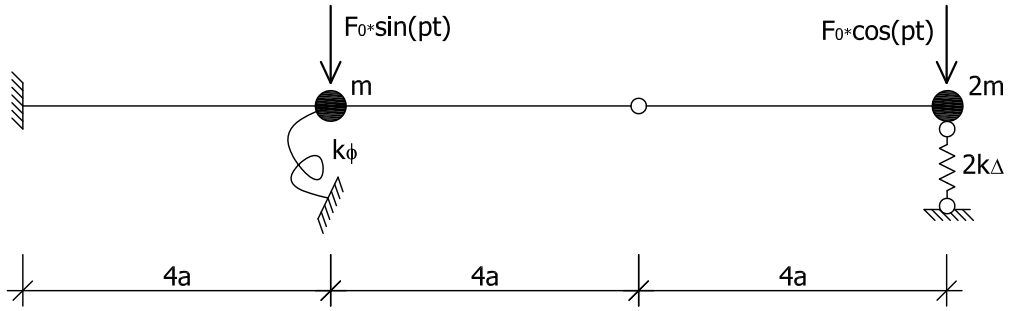
Numer Albumu	Numer tematu
232863	2
263159	5
252023	8
276973	11
233607	14
252076	17
244420	20
276979	23
251980	26
169615	29
276970	32
248521	35
248299	38
244524	41
252172	44
244686	47
252181	50
248420	53
252215	56
248467	59
244313	62
225066	65
248246	68
187393	71
248238	74
248253	77

Numer Albumu	Numer tematu
251399	3
211599	6
276972	9
248344	12
216658	15
251971	18
252277	21
248383	24
248111	27
251970	30
248519	33
252126	36
248429	39
248278	42
248294	45
247488	48
244541	51
248401	54
276977	57
252097	60
273500	63
252176	66
248056	69
248106	72
244634	75

1

$$a = 1,0 \text{ m}, F_0 = 3 \text{ kN}, m = 1500 \text{ kg},$$

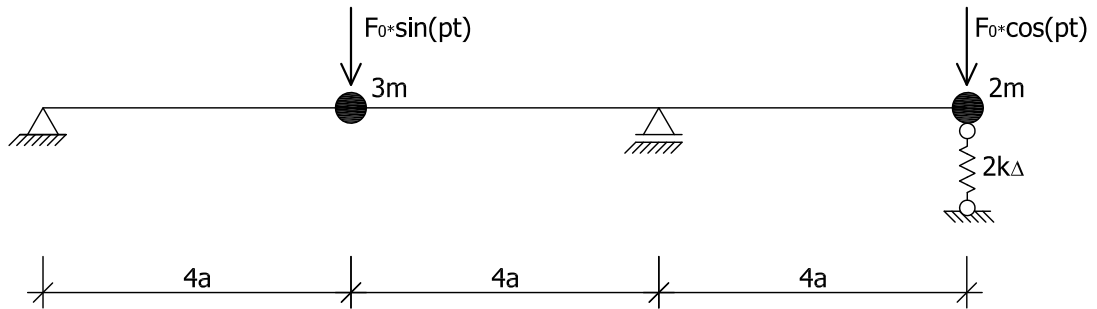
$$k_{\Delta} = 4EJ/3a^3, k_{\phi} = 2EJ/3a$$



2

$$a = 1,0 \text{ m}, F_0 = 3 \text{ kN}, m = 1500 \text{ kg},$$

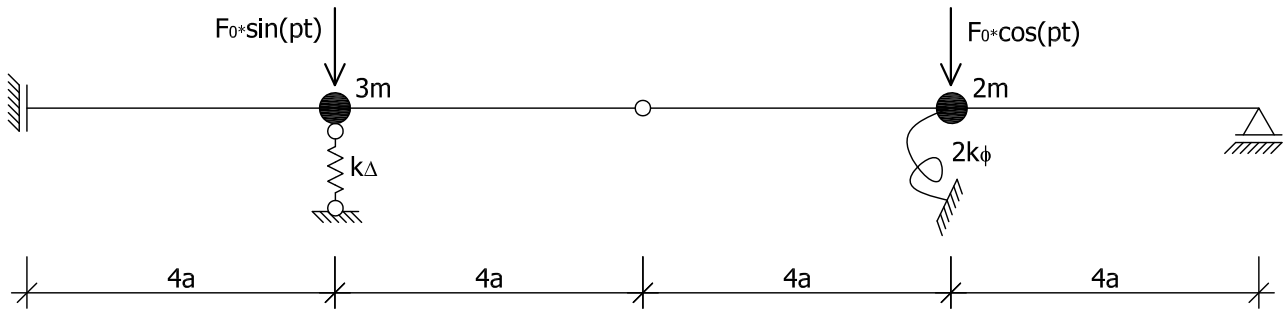
$$k_{\Delta} = EJ/3a^3$$



3

$$a = 1,2 \text{ m}, F_0 = 2,5 \text{ kN}, m = 2200 \text{ kg},$$

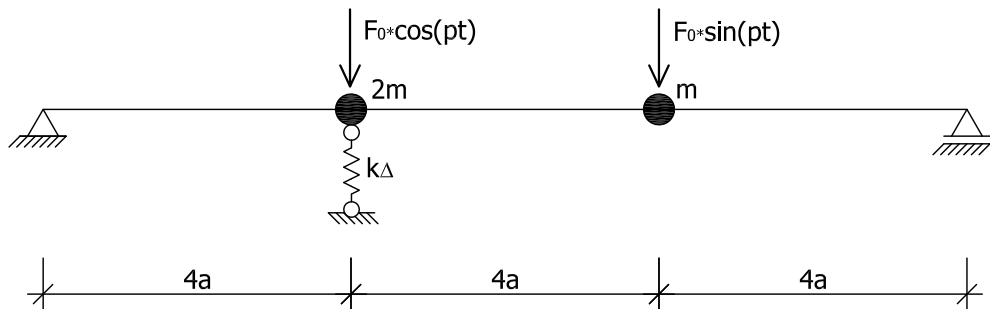
$$k_{\Delta} = 5EJ/3a^3, k_{\phi} = 4EJ/3a$$



4

$$a = 1,0 \text{ m}, F_0 = 3,5 \text{ kN}, m = 2000 \text{ kg},$$

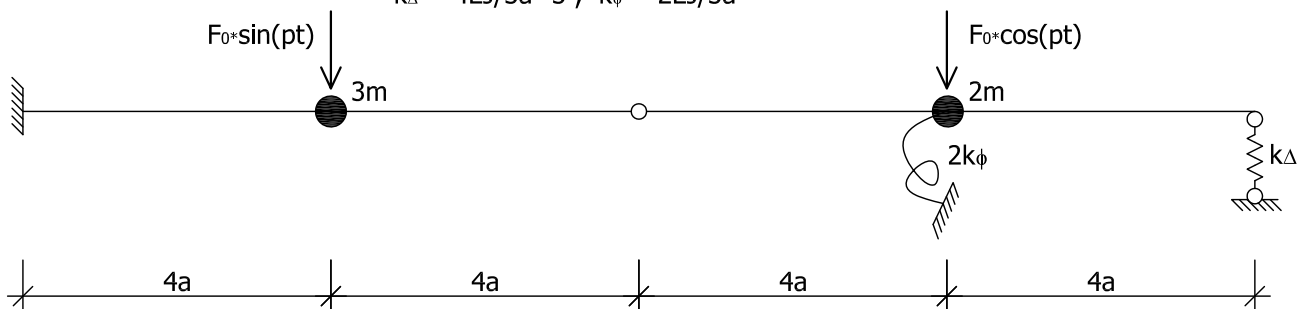
$$k_{\Delta} = 4EJ/3a^3$$



5

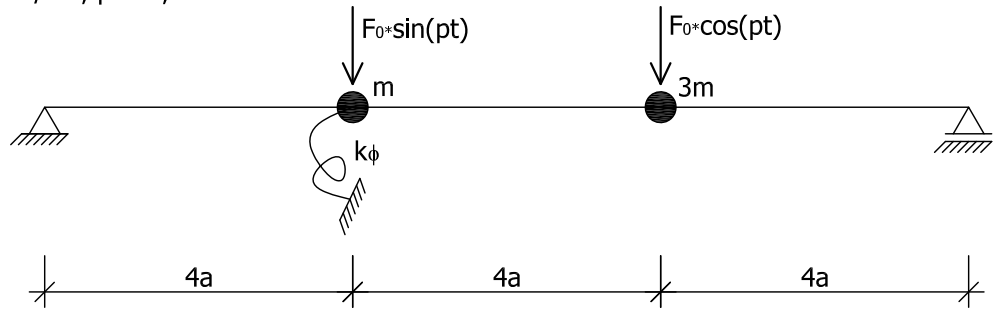
$$a = 1,0 \text{ m}, F_0 = 1,5 \text{ kN}, m = 1300 \text{ kg},$$

$$k_{\Delta} = 4EJ/3a^3, k_{\phi} = 2EJ/3a$$



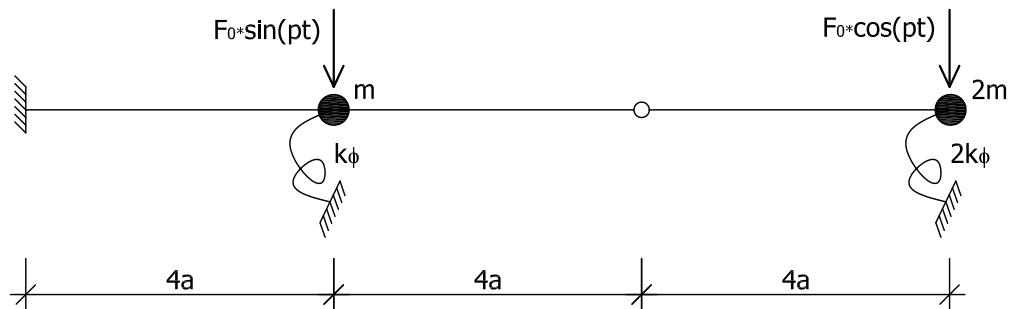
6

$a = 1,0 \text{ m}$, $F_0 = 2,5 \text{ kN}$, $m = 2000 \text{ kg}$,
 $k_\phi = 4EJ/3a$, $p = 0,95\omega_2$



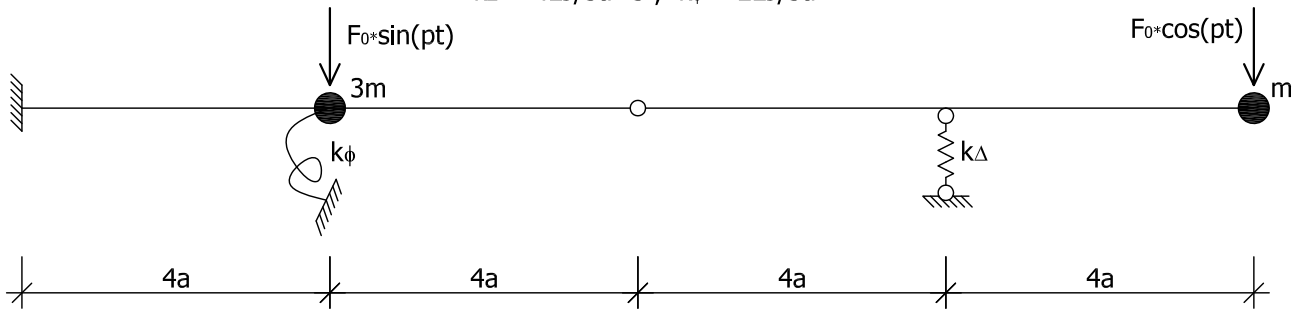
7

$a = 1,0 \text{ m}$, $F_0 = 3 \text{ kN}$, $m = 1500 \text{ kg}$,
 $k_\Delta = 4EJ/3a^3$, $k_\phi = 2EJ/3a$



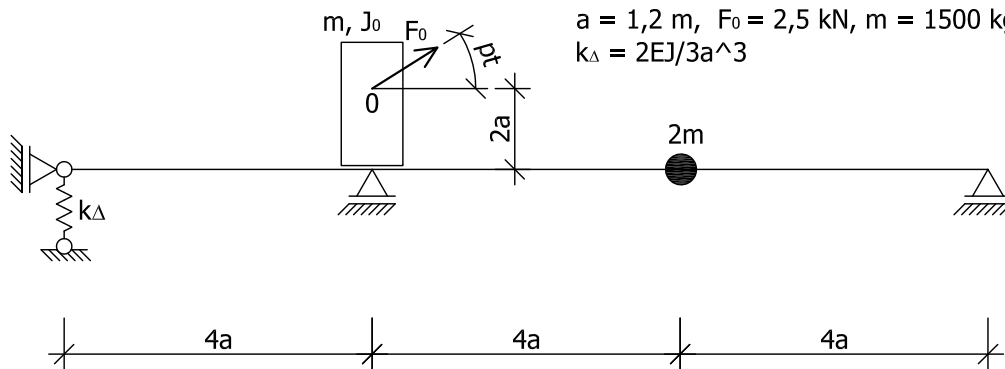
8

$a = 0,8 \text{ m}$, $F_0 = 2,5 \text{ kN}$, $m = 2200 \text{ kg}$,
 $k_\Delta = 4EJ/3a^3$, $k_\phi = 2EJ/3a$



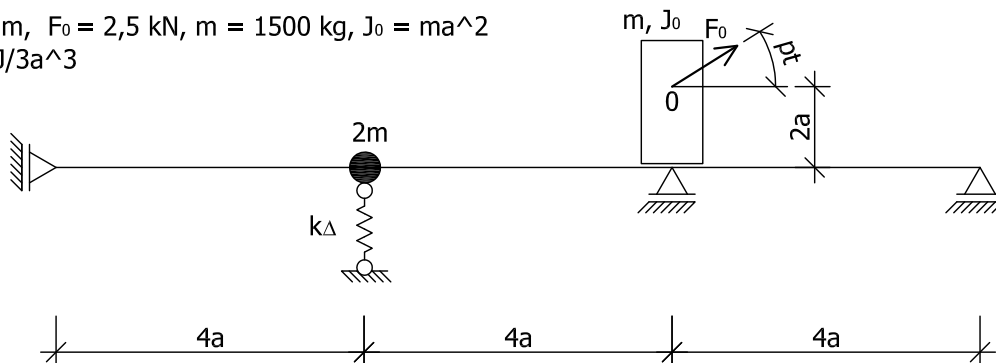
9

$a = 1,2 \text{ m}$, $F_0 = 2,5 \text{ kN}$, $m = 1500 \text{ kg}$, $J_0 = 0,5ma^2$,
 $k_\Delta = 2EJ/3a^3$



10

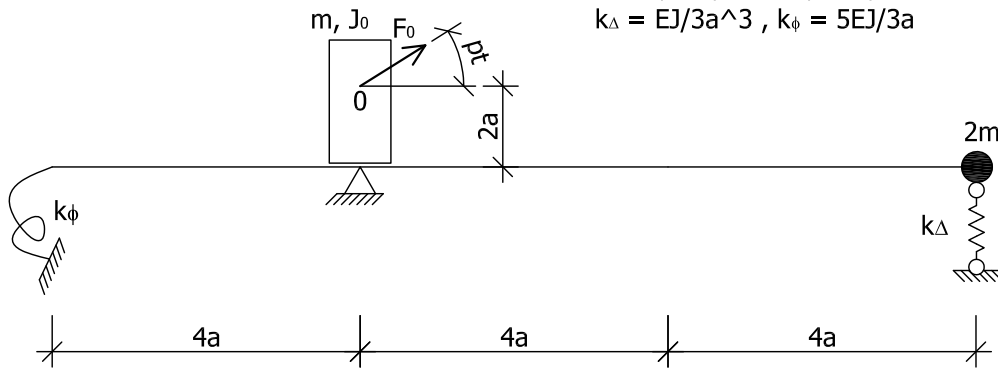
$a = 1,2 \text{ m}$, $F_0 = 2,5 \text{ kN}$, $m = 1500 \text{ kg}$, $J_0 = ma^2$,
 $k_\Delta = 4EJ/3a^3$



11

$$a = 1,0 \text{ m}, F_0 = 3,2 \text{ kN}, m = 1500 \text{ kg}, J_0 = ma^2$$

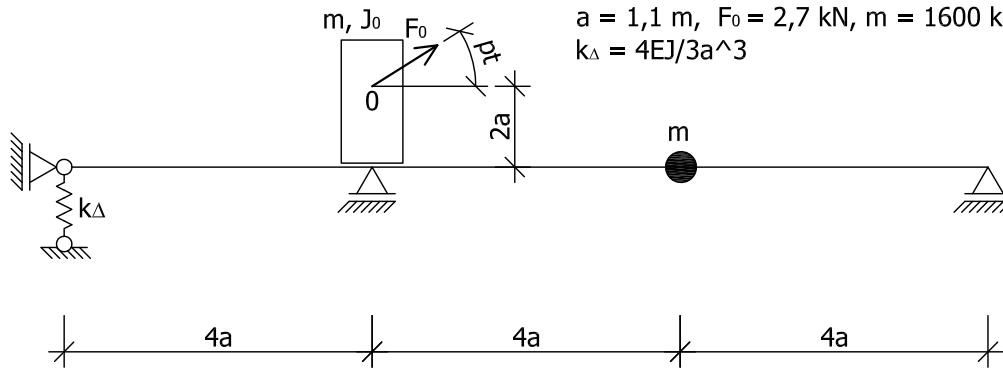
$$k_\Delta = EJ/3a^3, k_\phi = 5EJ/3a$$



12

$$a = 1,1 \text{ m}, F_0 = 2,7 \text{ kN}, m = 1600 \text{ kg}, J_0 = 0,5ma^2$$

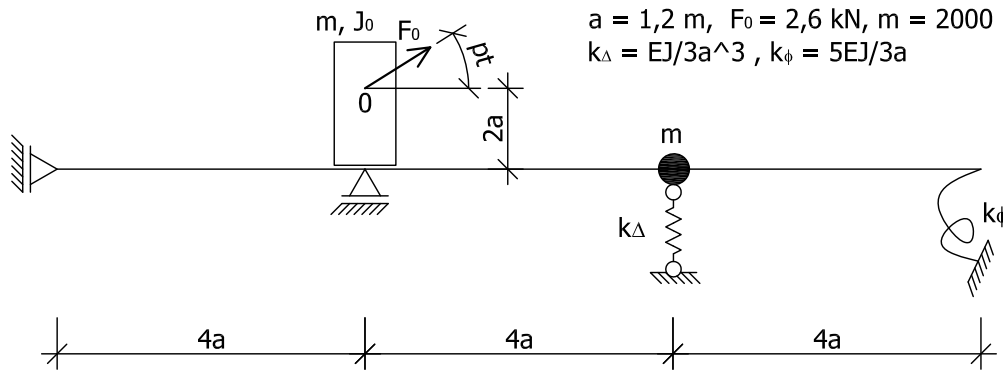
$$k_\Delta = 4EJ/3a^3$$



13

$$a = 1,2 \text{ m}, F_0 = 2,6 \text{ kN}, m = 2000 \text{ kg}, J_0 = 0,5ma^2$$

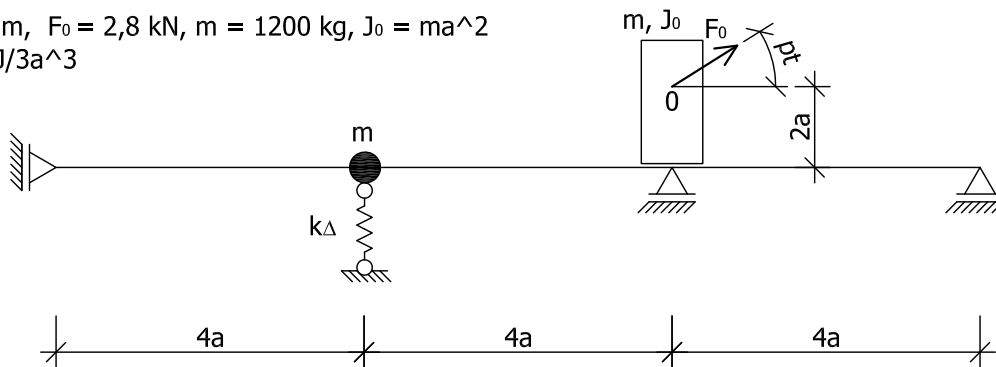
$$k_\Delta = EJ/3a^3, k_\phi = 5EJ/3a$$



14

$$a = 1,1 \text{ m}, F_0 = 2,8 \text{ kN}, m = 1200 \text{ kg}, J_0 = ma^2$$

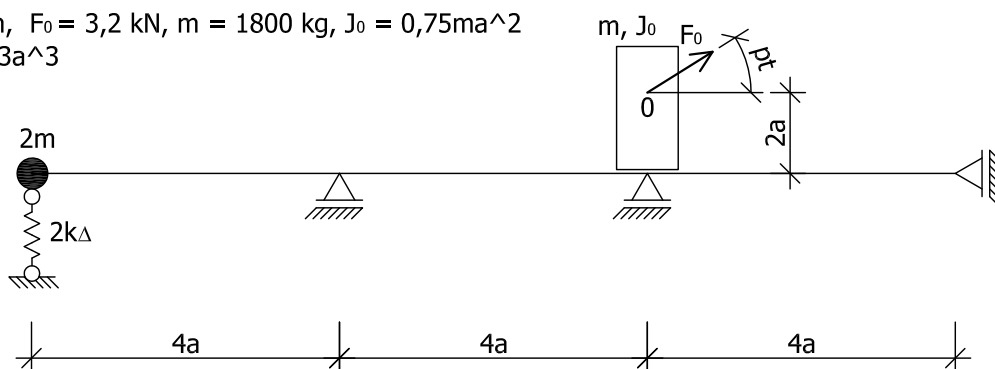
$$k_\Delta = 8EJ/3a^3$$



15

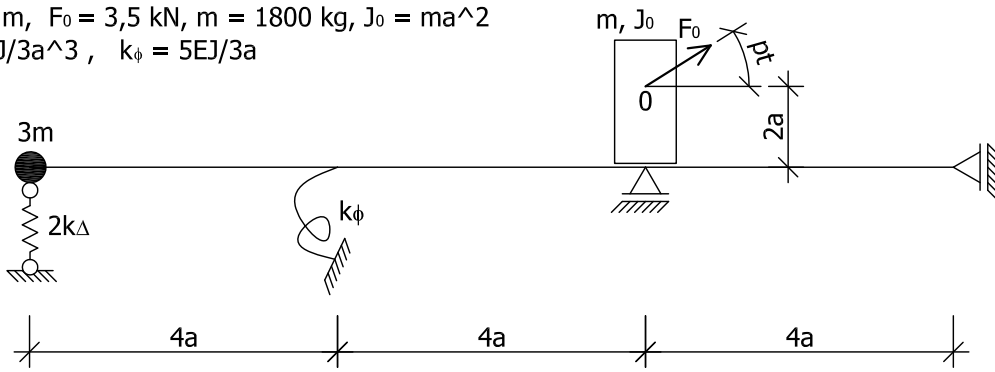
$$a = 1,0 \text{ m}, F_0 = 3,2 \text{ kN}, m = 1800 \text{ kg}, J_0 = 0,75ma^2$$

$$k_\Delta = 5EJ/3a^3$$



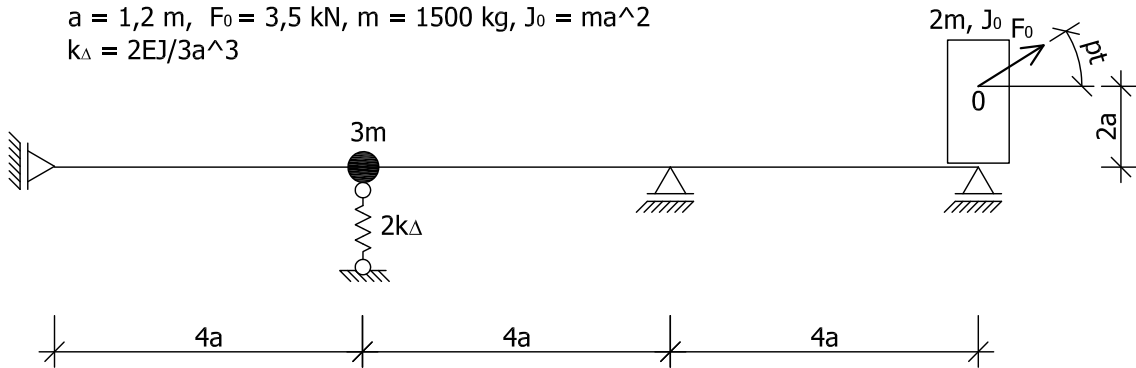
16

$a = 1,0 \text{ m}$, $F_0 = 3,5 \text{ kN}$, $m = 1800 \text{ kg}$, $J_0 = ma^2$
 $k_{\Delta} = 4EJ/3a^3$, $k_{\phi} = 5EJ/3a$



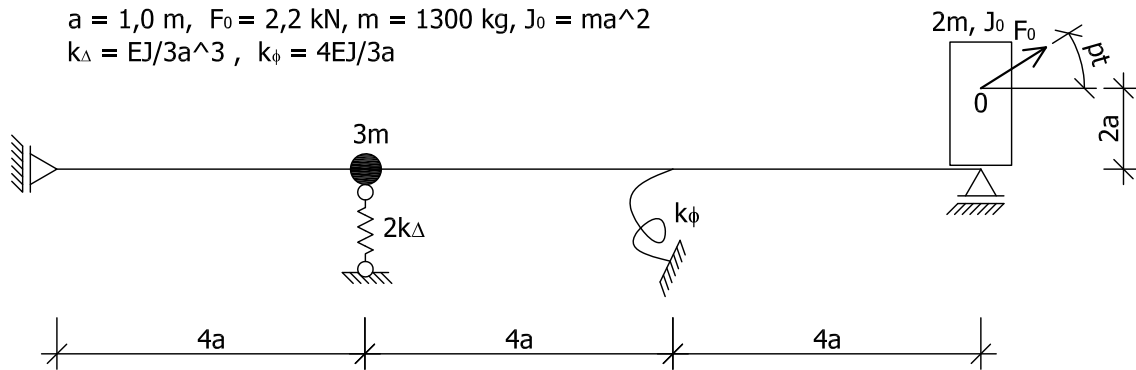
17

$a = 1,2 \text{ m}$, $F_0 = 3,5 \text{ kN}$, $m = 1500 \text{ kg}$, $J_0 = ma^2$
 $k_{\Delta} = 2EJ/3a^3$



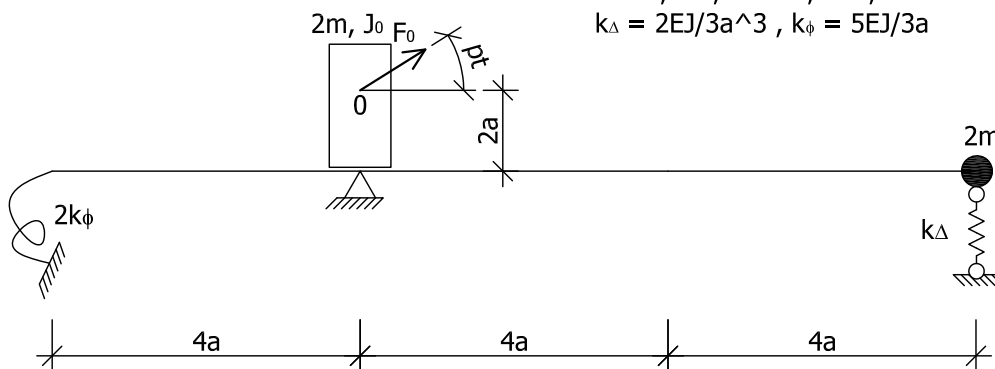
18

$a = 1,0 \text{ m}$, $F_0 = 2,2 \text{ kN}$, $m = 1300 \text{ kg}$, $J_0 = ma^2$
 $k_{\Delta} = EJ/3a^3$, $k_{\phi} = 4EJ/3a$



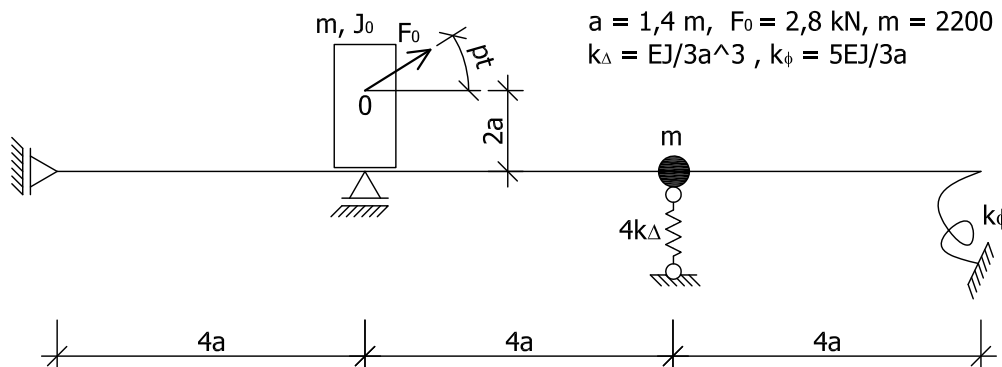
19

$a = 1,1 \text{ m}$, $F_0 = 3,4 \text{ kN}$, $m = 1500 \text{ kg}$, $J_0 = ma^2$
 $k_{\Delta} = 2EJ/3a^3$, $k_{\phi} = 5EJ/3a$



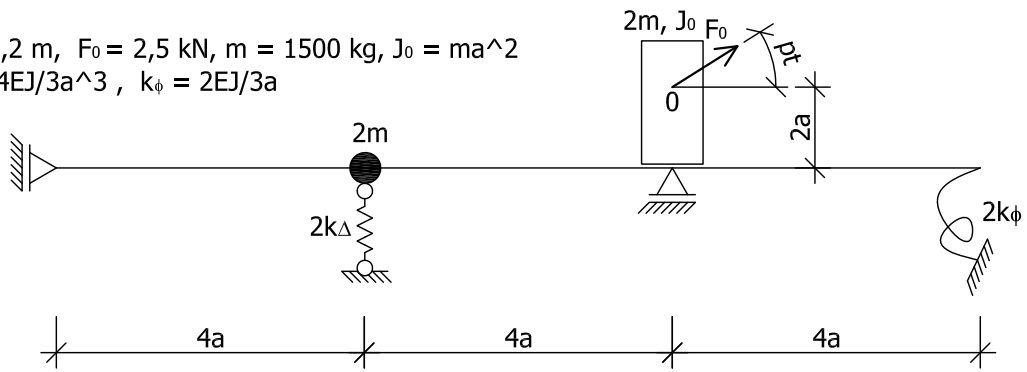
20

$a = 1,4 \text{ m}$, $F_0 = 2,8 \text{ kN}$, $m = 2200 \text{ kg}$, $J_0 = 0,5ma^2$
 $k_{\Delta} = EJ/3a^3$, $k_{\phi} = 5EJ/3a$



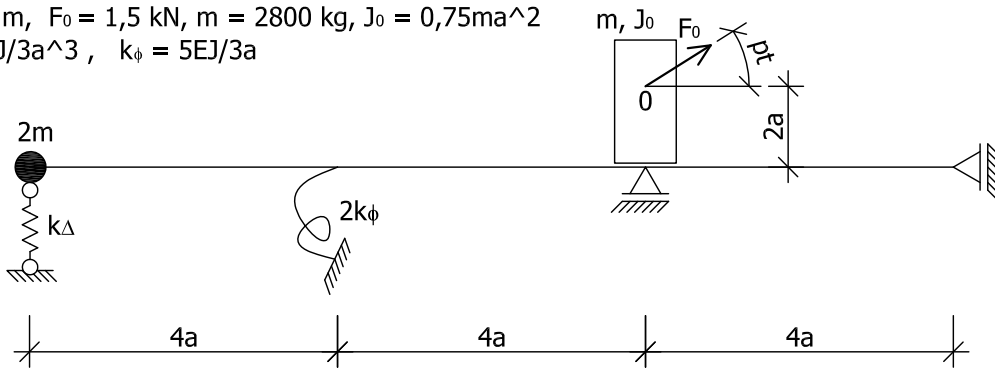
21

$a = 1,2 \text{ m}$, $F_0 = 2,5 \text{ kN}$, $m = 1500 \text{ kg}$, $J_0 = ma^2$
 $k_{\Delta} = 4EJ/3a^3$, $k_{\phi} = 2EJ/3a$



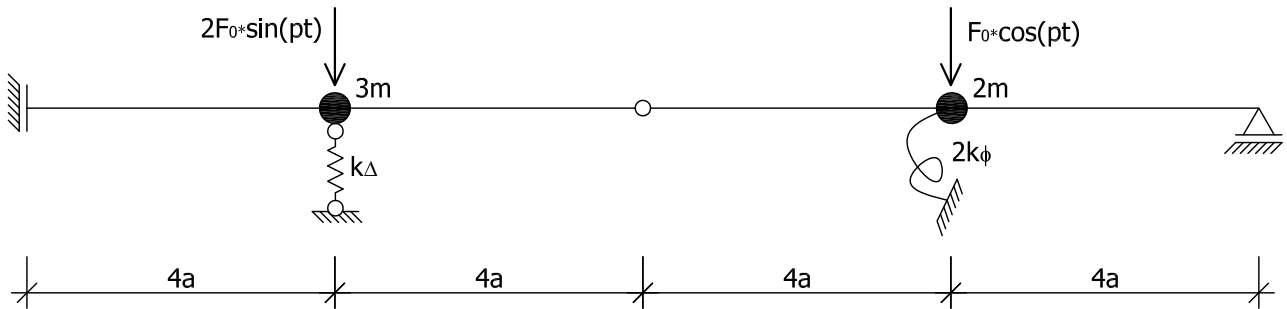
22

$a = 0,9 \text{ m}$, $F_0 = 1,5 \text{ kN}$, $m = 2800 \text{ kg}$, $J_0 = 0,75ma^2$
 $k_{\Delta} = 4EJ/3a^3$, $k_{\phi} = 5EJ/3a$



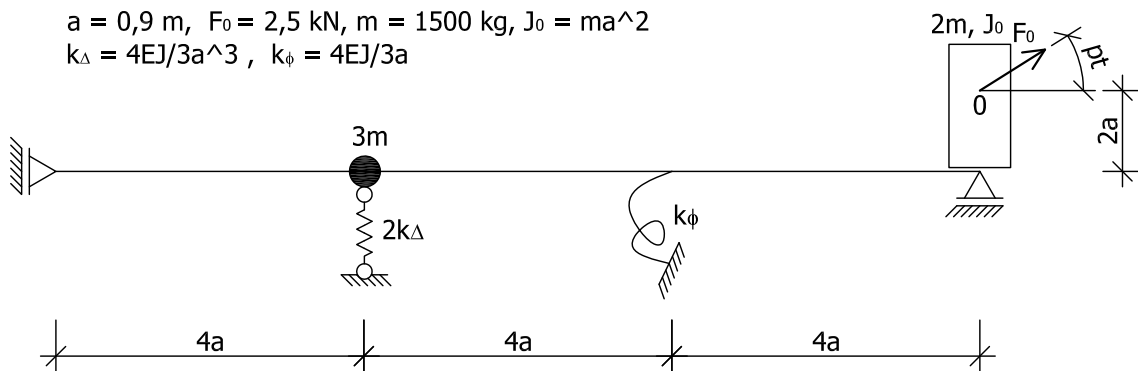
23

$a = 1,2 \text{ m}$, $F_0 = 3,5 \text{ kN}$, $m = 2400 \text{ kg}$,
 $k_{\Delta} = 5EJ/3a^3$, $k_{\phi} = 2EJ/3a$



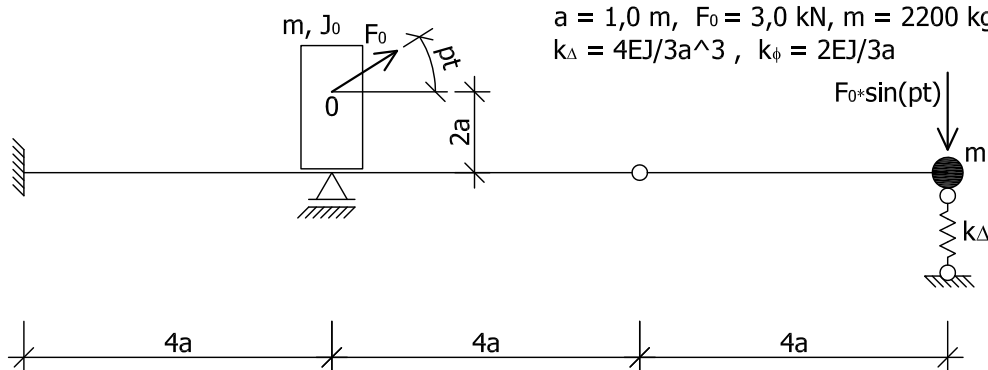
24

$a = 0,9 \text{ m}$, $F_0 = 2,5 \text{ kN}$, $m = 1500 \text{ kg}$, $J_0 = ma^2$
 $k_{\Delta} = 4EJ/3a^3$, $k_{\phi} = 4EJ/3a$



25

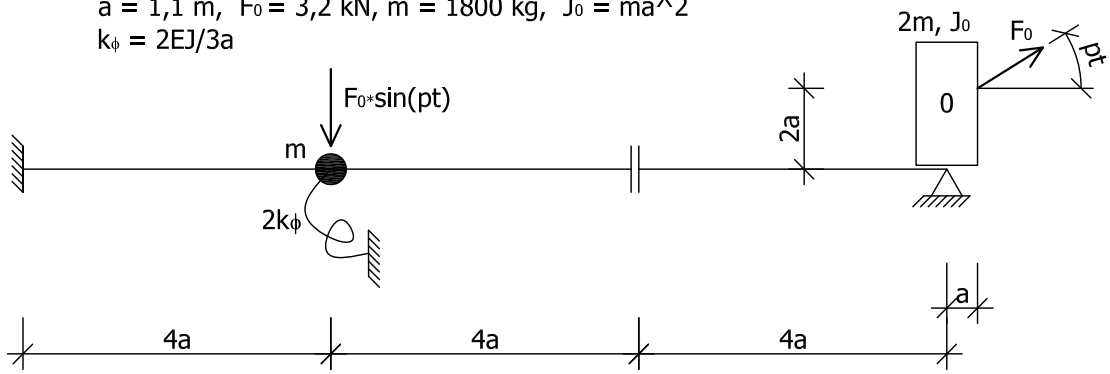
$a = 1,0 \text{ m}$, $F_0 = 3,0 \text{ kN}$, $m = 2200 \text{ kg}$, $J_0 = ma^2$
 $k_{\Delta} = 4EJ/3a^3$, $k_{\phi} = 2EJ/3a$



26

$$a = 1,1 \text{ m}, F_0 = 3,2 \text{ kN}, m = 1800 \text{ kg}, J_0 = ma^2$$

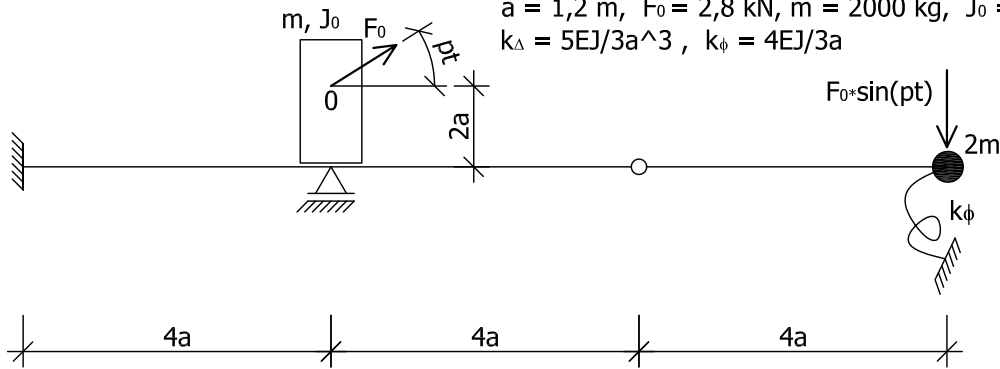
$$k_\phi = 2EJ/3a$$



27

$$a = 1,2 \text{ m}, F_0 = 2,8 \text{ kN}, m = 2000 \text{ kg}, J_0 = 0,75ma^2$$

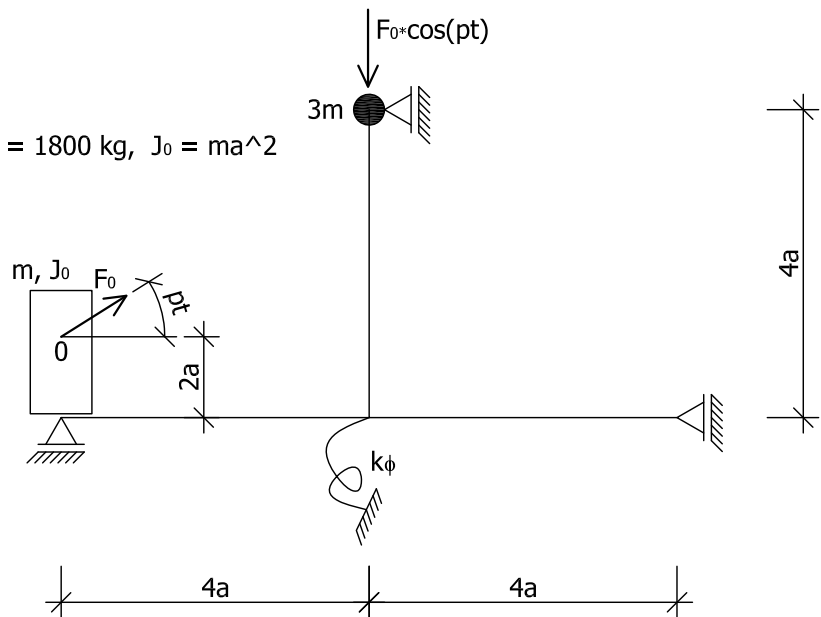
$$k_\Delta = 5EJ/3a^3, k_\phi = 4EJ/3a$$



28

$$a = 1,0 \text{ m}, F_0 = 3 \text{ kN}, m = 1800 \text{ kg}, J_0 = ma^2$$

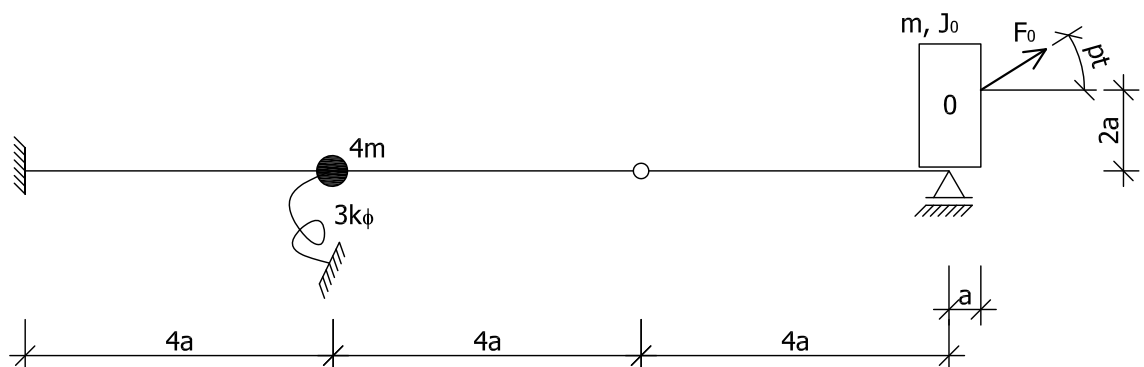
$$k_\phi = 2EJ/3a$$



29

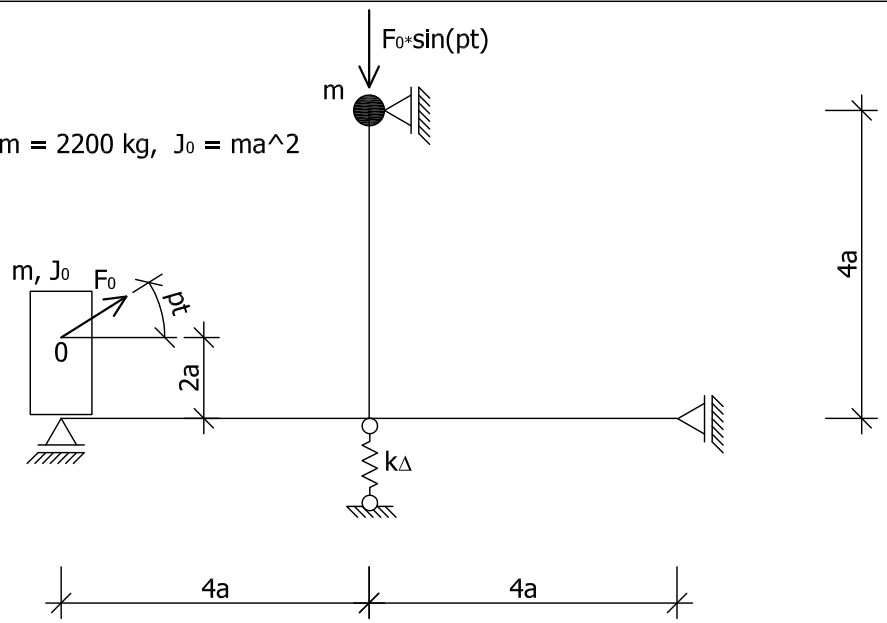
$$a = 1,2 \text{ m}, F_0 = 2,5 \text{ kN}, m = 2200 \text{ kg}, J_0 = 0,5ma^2$$

$$k_\Delta = 5EJ/3a^3, k_\phi = 4EJ/3a$$



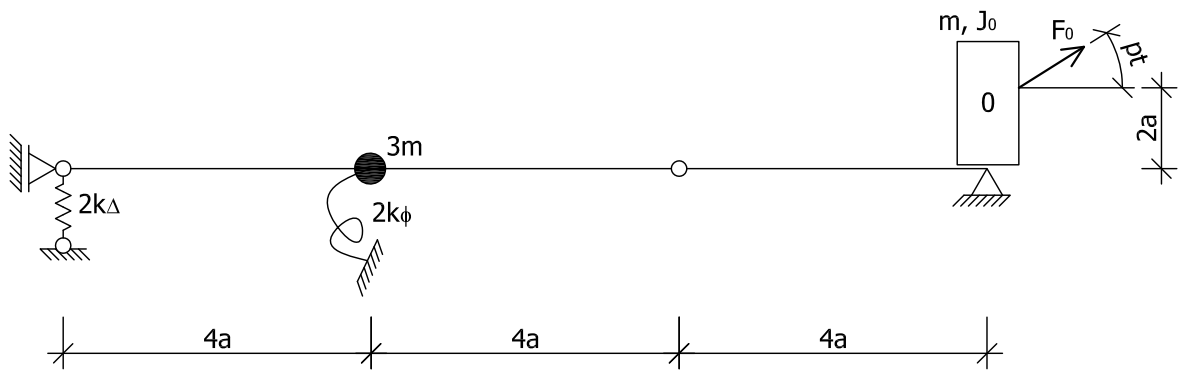
30

$a = 1,2 \text{ m}$, $F_0 = 2,5 \text{ kN}$, $m = 2200 \text{ kg}$, $J_0 = ma^2$
 $k_\Delta = 4EJ/3a^3$



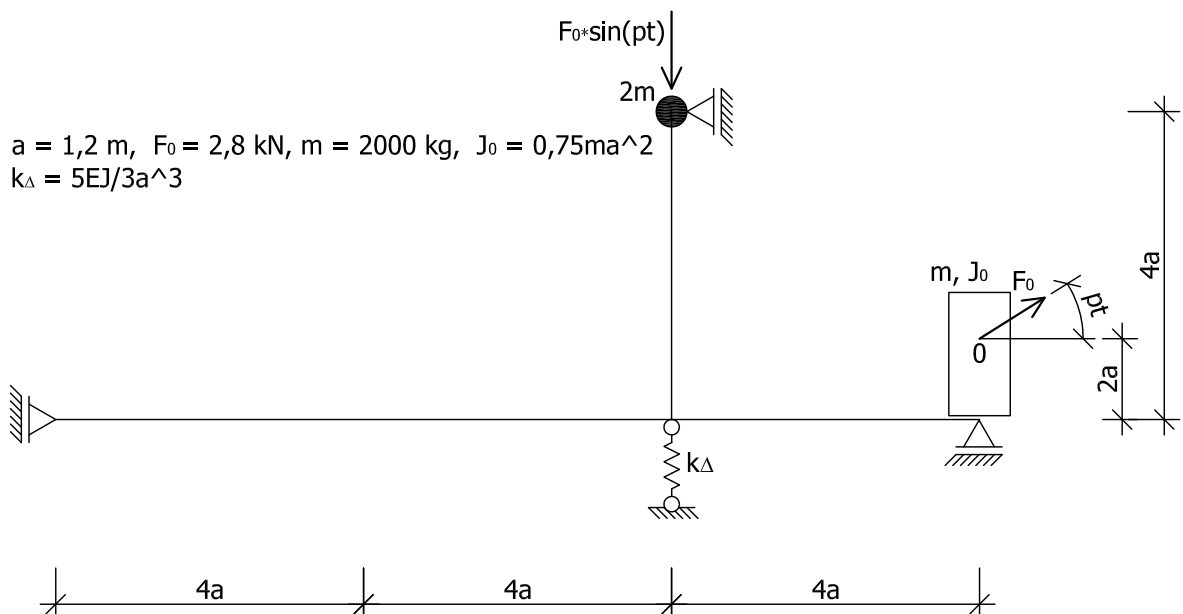
31

$a = 1,1 \text{ m}$, $F_0 = 1,5 \text{ kN}$, $m = 1300 \text{ kg}$, $J_0 = 0,5ma^2$
 $k_\Delta = 4EJ/3a^3$, $k_\phi = 2EJ/3a$



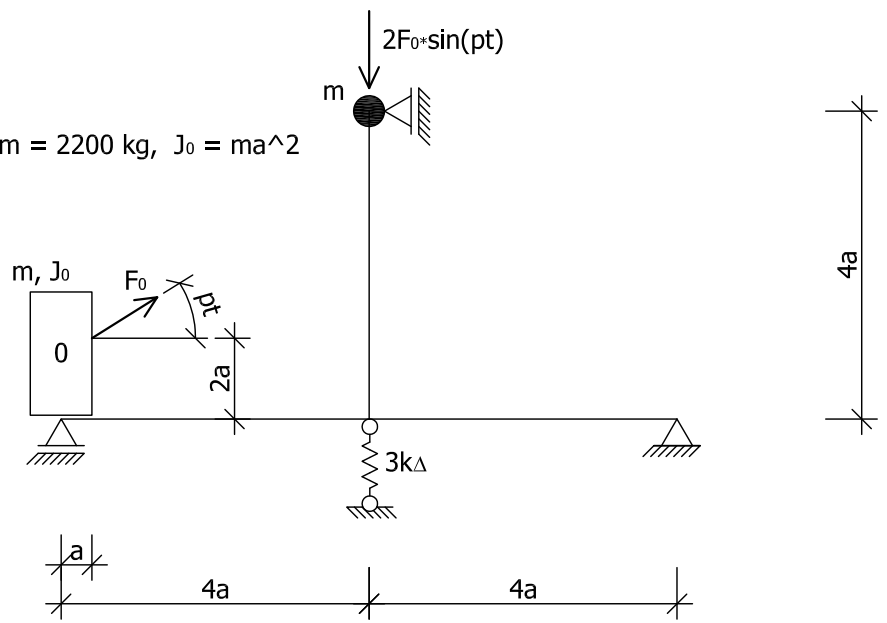
32

$a = 1,2 \text{ m}$, $F_0 = 2,8 \text{ kN}$, $m = 2000 \text{ kg}$, $J_0 = 0,75ma^2$
 $k_\Delta = 5EJ/3a^3$



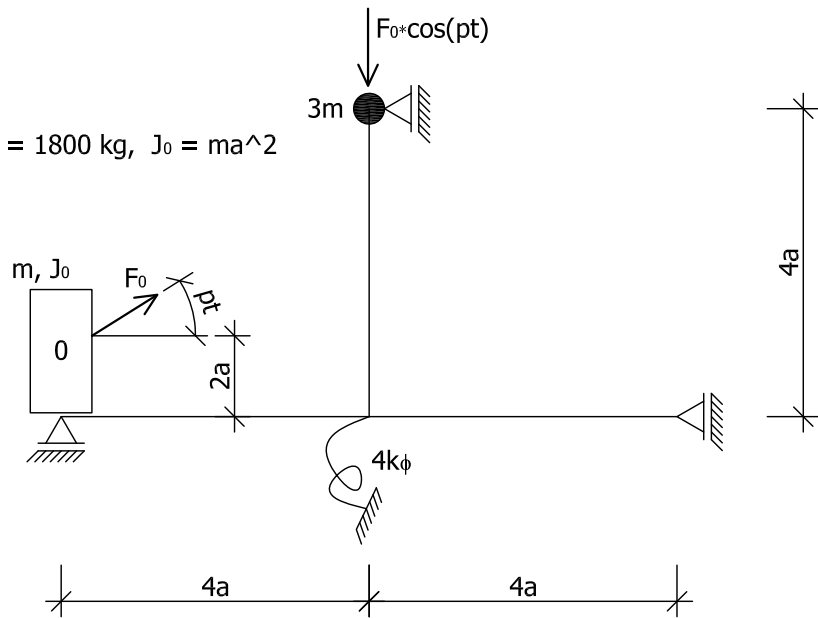
33

$a = 1,2 \text{ m}$, $F_0 = 2,5 \text{ kN}$, $m = 2200 \text{ kg}$, $J_0 = ma^2$
 $k_{\Delta} = 4EJ/3a^3$



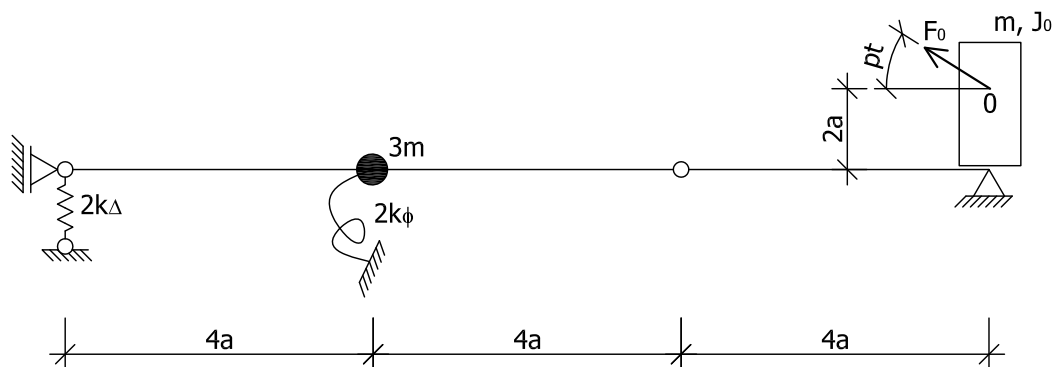
34

$a = 1,0 \text{ m}$, $F_0 = 3 \text{ kN}$, $m = 1800 \text{ kg}$, $J_0 = ma^2$
 $k_{\phi} = 2EJ/3a$



35

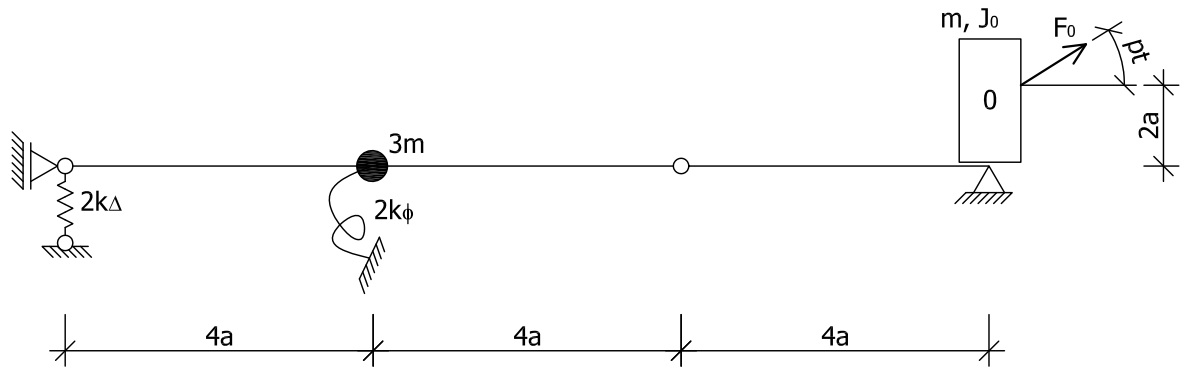
$a = 1,1 \text{ m}$, $F_0 = 4,5 \text{ kN}$, $m = 1700 \text{ kg}$, $J_0 = 0,75ma^2$
 $k_{\Delta} = 4EJ/3a^3$, $k_{\phi} = 2EJ/3a$



36

$$a = 1,1 \text{ m}, F_0 = 1,5 \text{ kN}, m = 1300 \text{ kg}, J_0 = 0,5ma^2$$

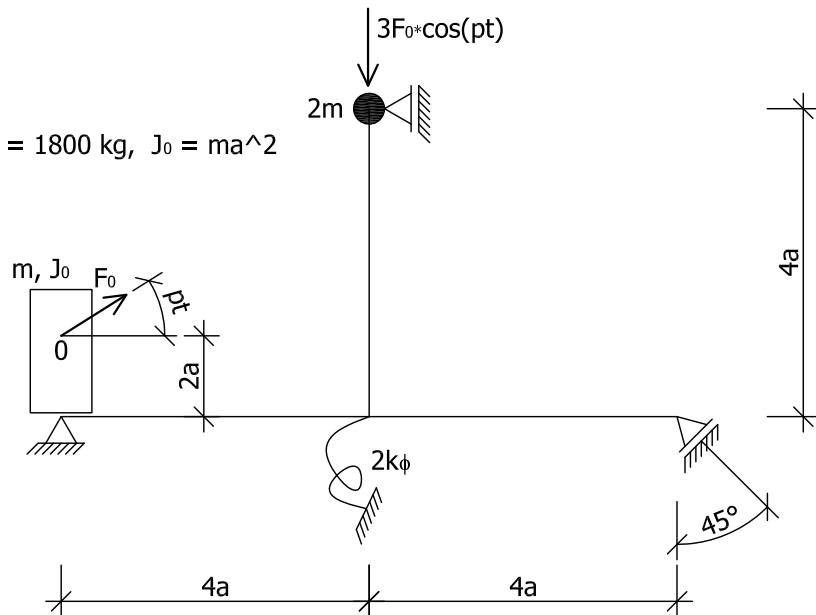
$$k_\Delta = 4EJ/3a^3, k_\phi = 2EJ/3a$$



37

$$a = 1,0 \text{ m}, F_0 = 3 \text{ kN}, m = 1800 \text{ kg}, J_0 = ma^2$$

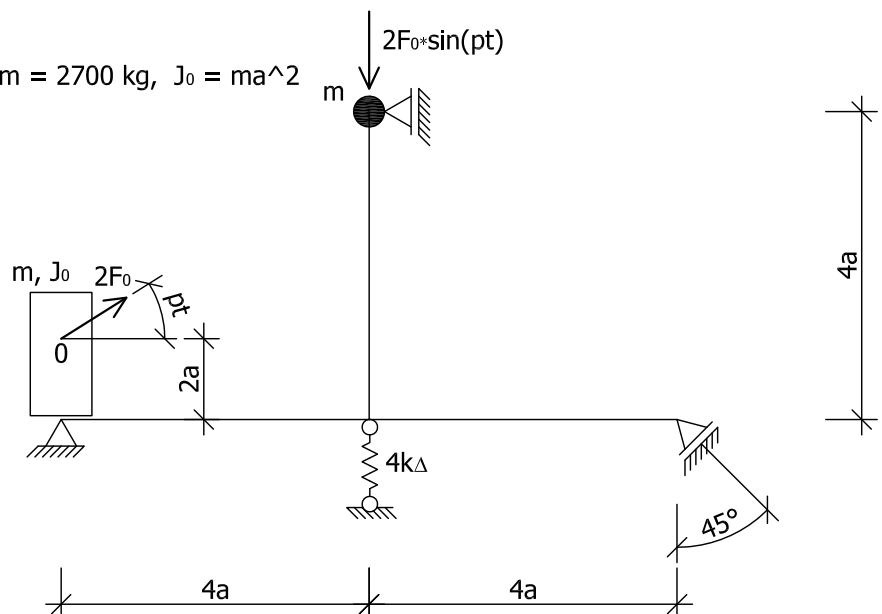
$$k_\phi = 2EJ/3a, p = 0,95\omega_1$$



38

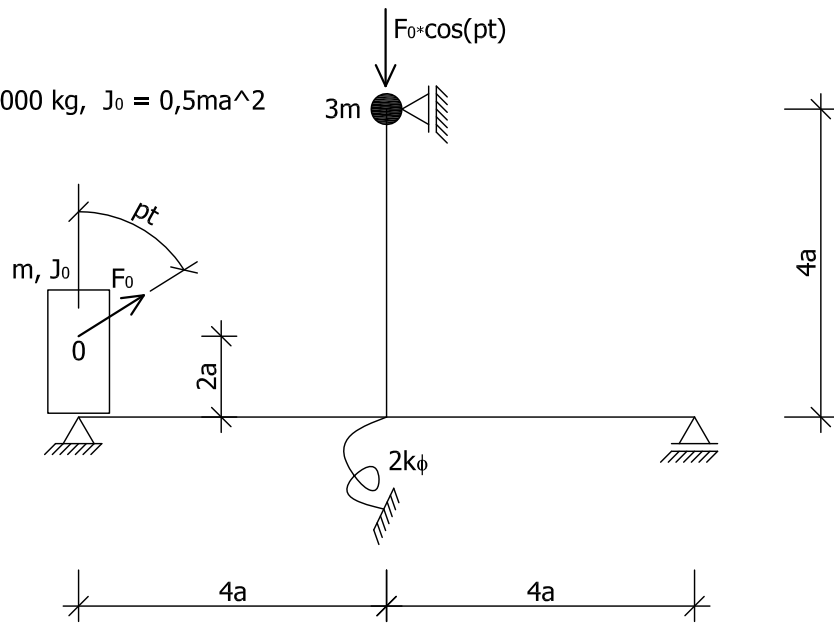
$$a = 1,0 \text{ m}, F_0 = 2,4 \text{ kN}, m = 2700 \text{ kg}, J_0 = ma^2$$

$$k_\Delta = 2EJ/3a^3$$



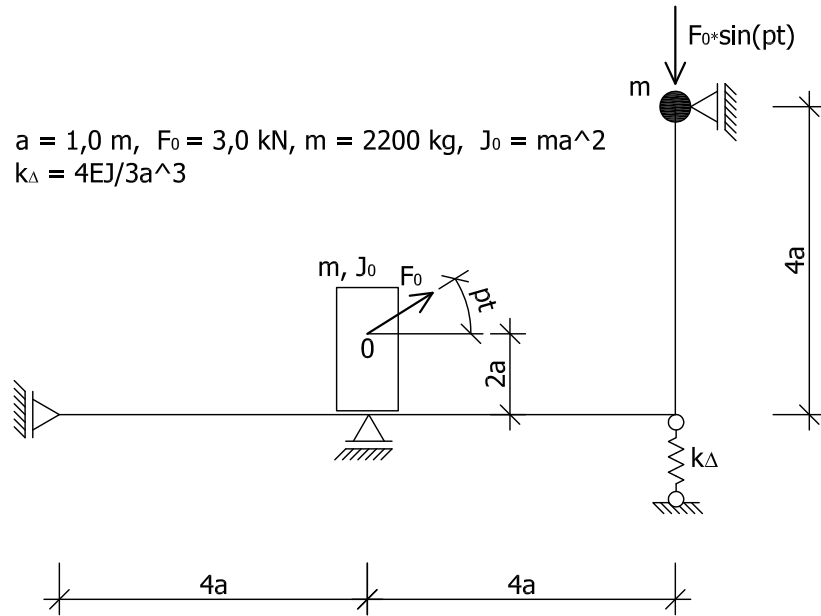
39

$a = 1,0 \text{ m}$, $F_0 = 3 \text{ kN}$, $m = 2000 \text{ kg}$, $J_0 = 0,5ma^2$
 $k_\phi = 2EJ/3a$



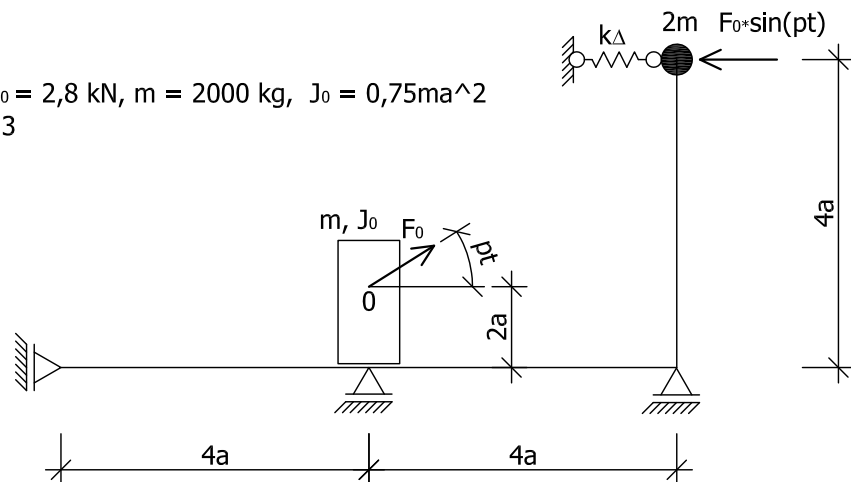
40

$a = 1,0 \text{ m}$, $F_0 = 3,0 \text{ kN}$, $m = 2200 \text{ kg}$, $J_0 = ma^2$
 $k_\Delta = 4EJ/3a^3$



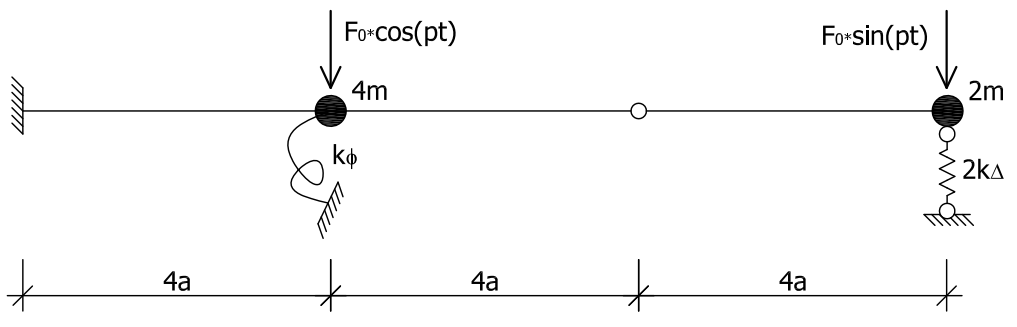
41

$a = 1,2 \text{ m}$, $F_0 = 2,8 \text{ kN}$, $m = 2000 \text{ kg}$, $J_0 = 0,75ma^2$
 $k_\Delta = 5EJ/3a^3$



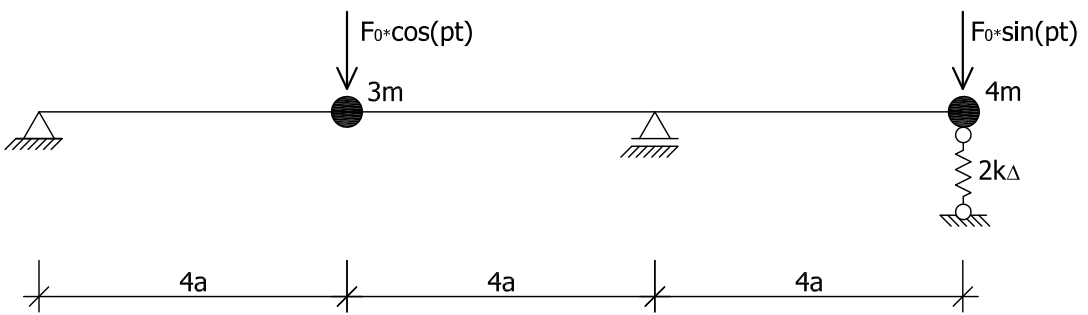
42

$a = 1,0 \text{ m}$, $F_0 = 3 \text{ kN}$, $m = 1500 \text{ kg}$,
 $k_{\Delta} = 4EJ/3a^3$, $k_{\phi} = 2EJ/3a$



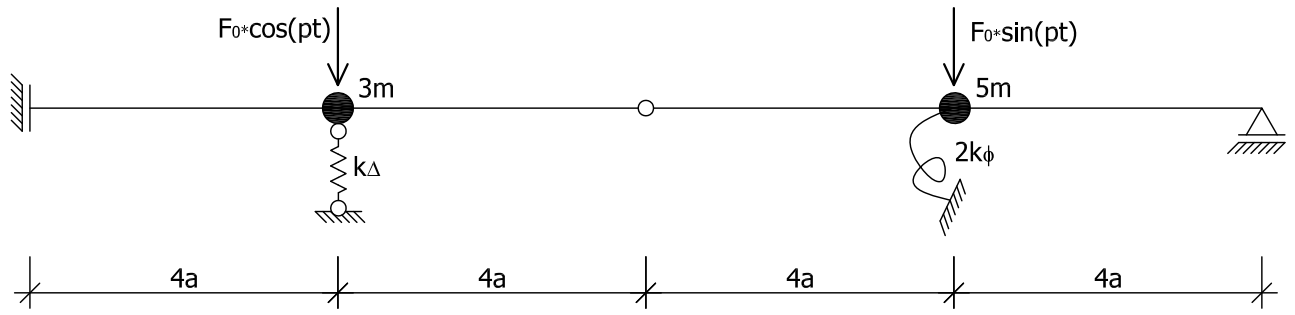
43

$a = 1,0 \text{ m}$, $F_0 = 3 \text{ kN}$, $m = 1500 \text{ kg}$,
 $k_{\Delta} = EJ/3a^3$



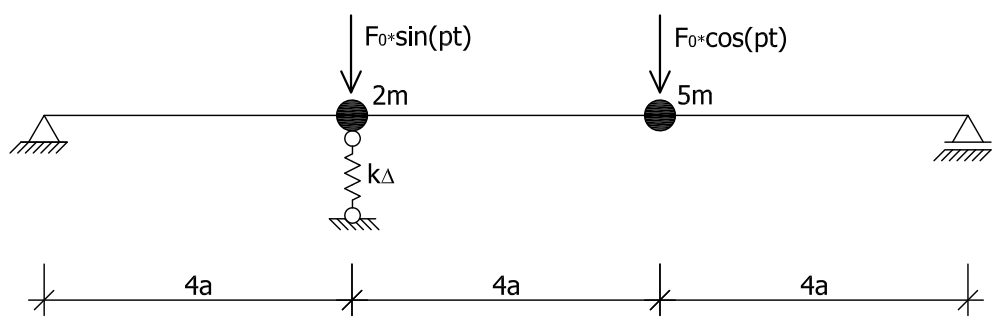
44

$a = 1,2 \text{ m}$, $F_0 = 2,5 \text{ kN}$, $m = 2200 \text{ kg}$,
 $k_{\Delta} = 5EJ/3a^3$, $k_{\phi} = 4EJ/3a$



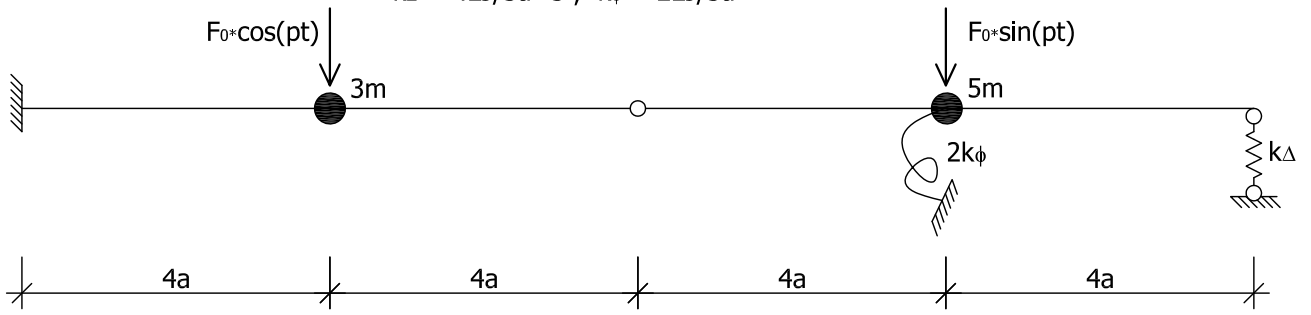
45

$a = 1,0 \text{ m}$, $F_0 = 3,5 \text{ kN}$, $m = 2000 \text{ kg}$,
 $k_{\Delta} = 4EJ/3a^3$



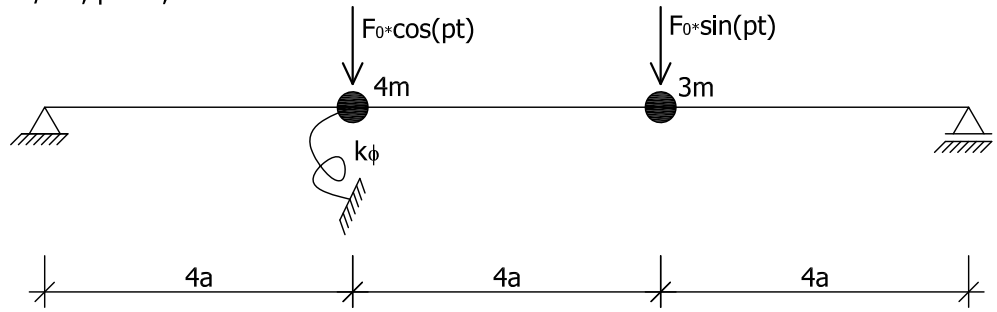
46

$a = 1,0 \text{ m}$, $F_0 = 1,5 \text{ kN}$, $m = 1300 \text{ kg}$,
 $k_{\Delta} = 4EJ/3a^3$, $k_{\phi} = 2EJ/3a$



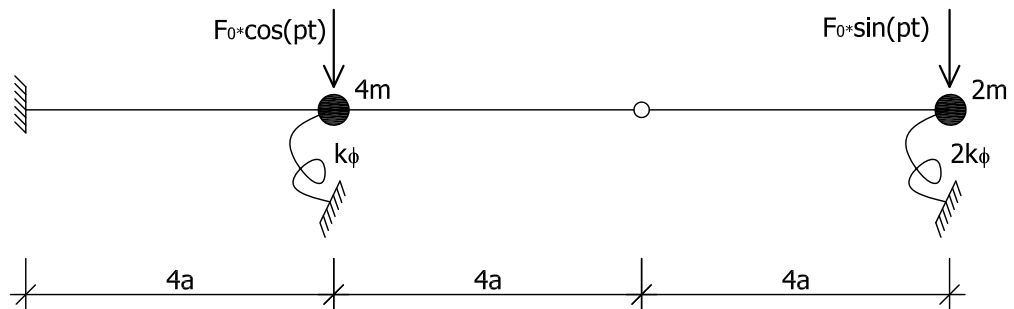
47

$a = 1,0 \text{ m}$, $F_0 = 2,5 \text{ kN}$, $m = 2000 \text{ kg}$,
 $k_\phi = 4EJ/3a$, $p = 0,95\omega_2$



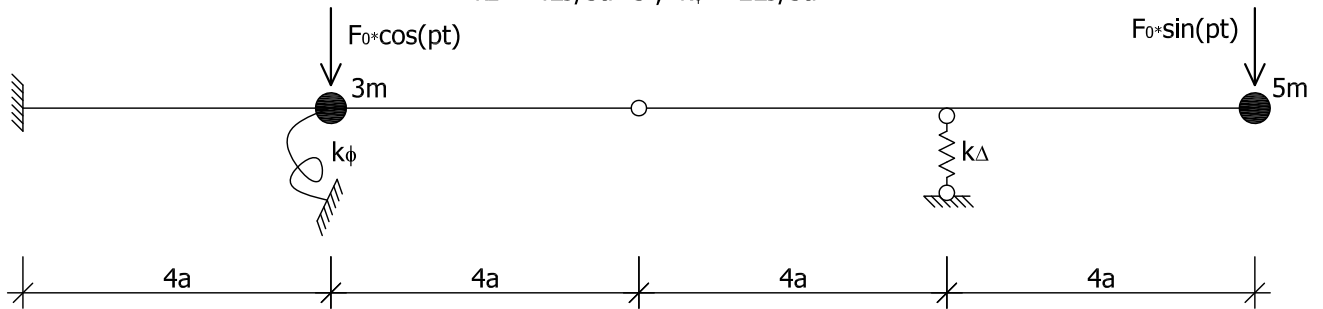
48

$a = 1,0 \text{ m}$, $F_0 = 3 \text{ kN}$, $m = 1500 \text{ kg}$,
 $k_\Delta = 4EJ/3a^3$, $k_\phi = 2EJ/3a$



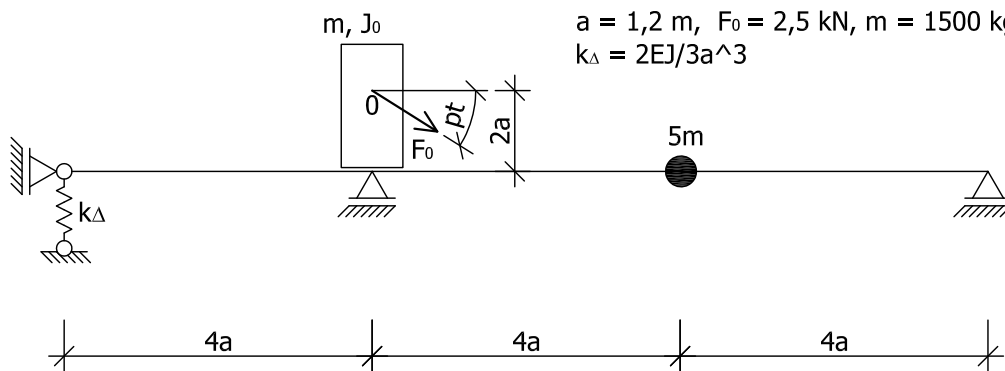
49

$a = 0,8 \text{ m}$, $F_0 = 2,5 \text{ kN}$, $m = 2200 \text{ kg}$,
 $k_\Delta = 4EJ/3a^3$, $k_\phi = 2EJ/3a$



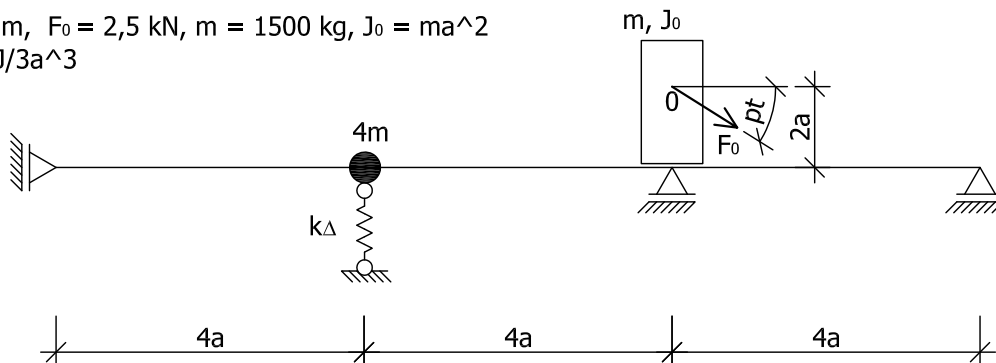
50

$a = 1,2 \text{ m}$, $F_0 = 2,5 \text{ kN}$, $m = 1500 \text{ kg}$, $J_0 = 0,5ma^2$,
 $k_\Delta = 2EJ/3a^3$



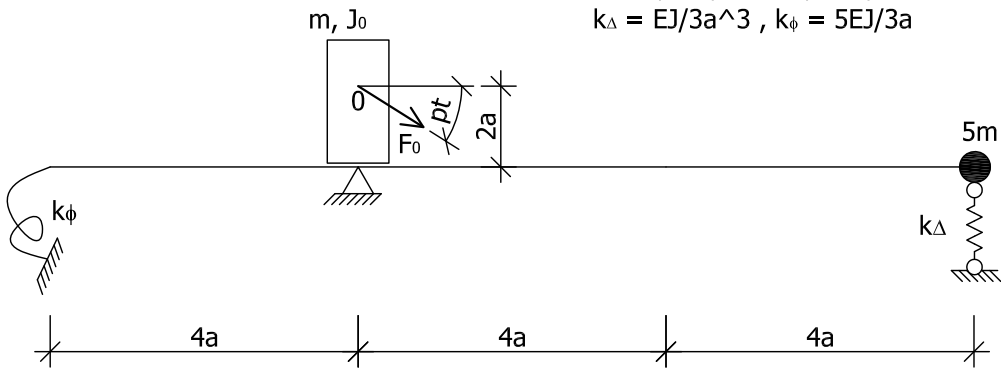
51

$a = 1,2 \text{ m}$, $F_0 = 2,5 \text{ kN}$, $m = 1500 \text{ kg}$, $J_0 = ma^2$,
 $k_\Delta = 4EJ/3a^3$



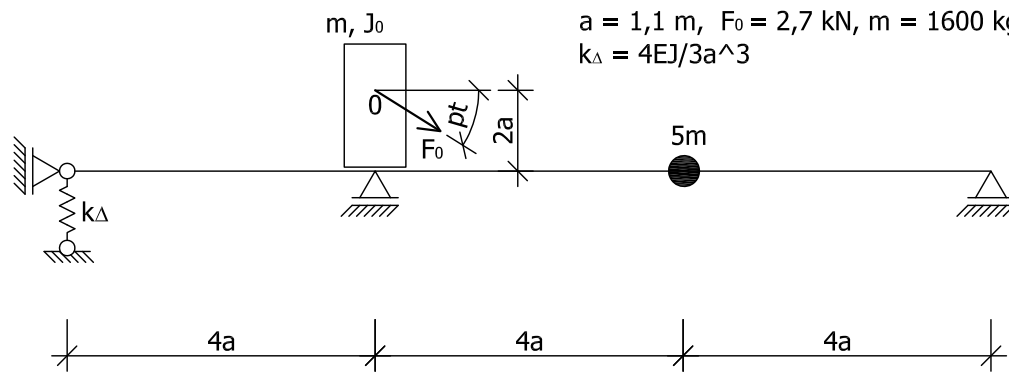
52

$a = 1,0 \text{ m}$, $F_0 = 3,2 \text{ kN}$, $m = 1500 \text{ kg}$, $J_0 = ma^2$
 $k_\Delta = EJ/3a^3$, $k_\phi = 5EJ/3a$



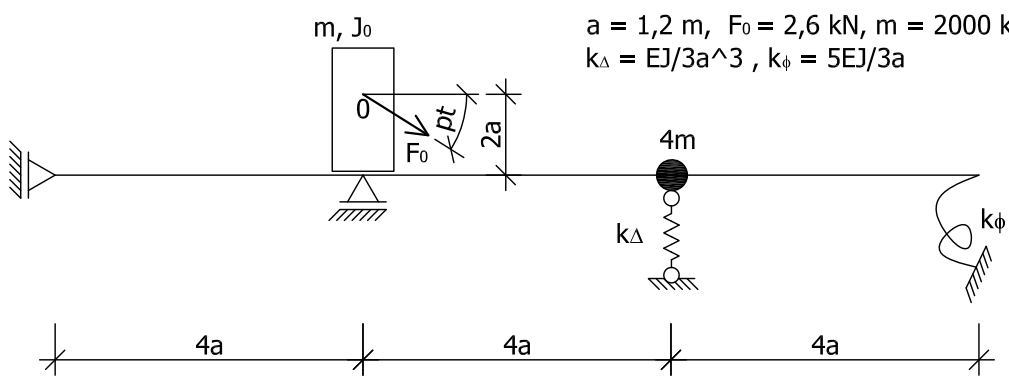
53

$a = 1,1 \text{ m}$, $F_0 = 2,7 \text{ kN}$, $m = 1600 \text{ kg}$, $J_0 = 0,5ma^2$
 $k_\Delta = 4EJ/3a^3$



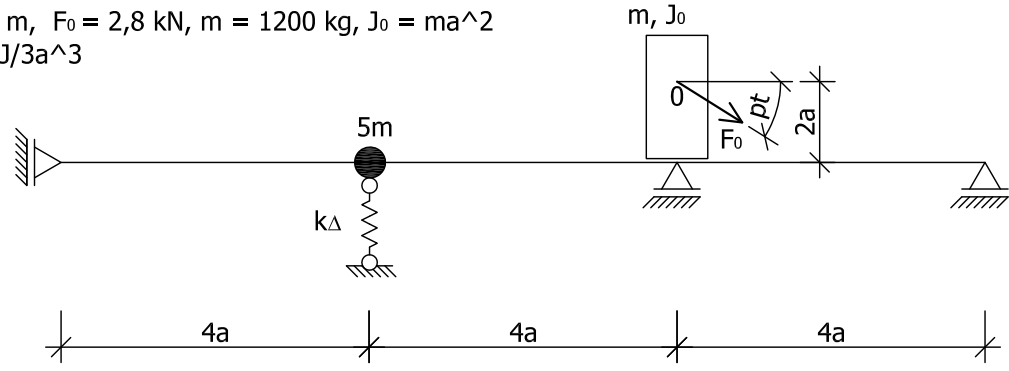
54

$a = 1,2 \text{ m}$, $F_0 = 2,6 \text{ kN}$, $m = 2000 \text{ kg}$, $J_0 = 0,5ma^2$
 $k_\Delta = EJ/3a^3$, $k_\phi = 5EJ/3a$



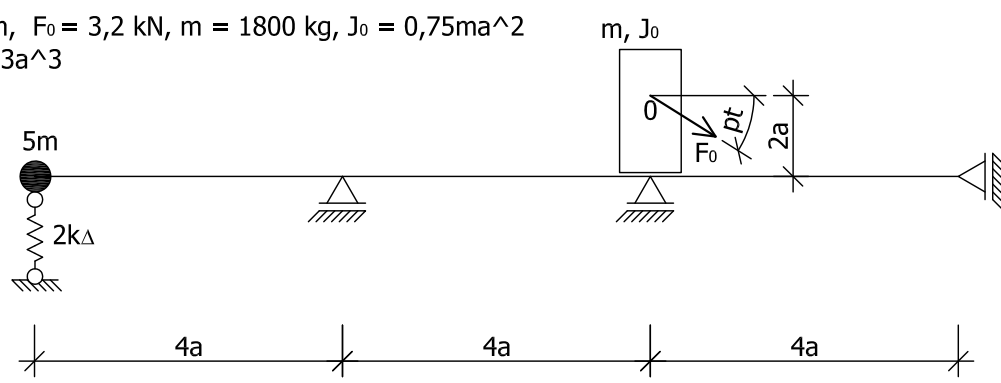
55

$a = 1,1 \text{ m}$, $F_0 = 2,8 \text{ kN}$, $m = 1200 \text{ kg}$, $J_0 = ma^2$
 $k_\Delta = 8EJ/3a^3$



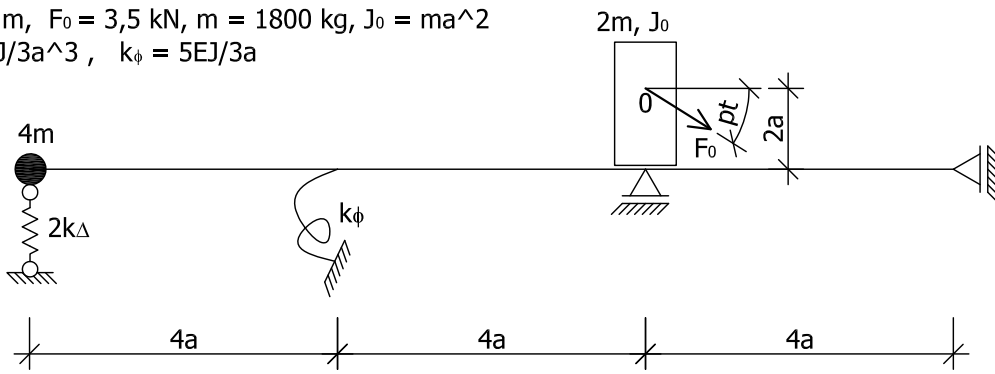
56

$a = 1,0 \text{ m}$, $F_0 = 3,2 \text{ kN}$, $m = 1800 \text{ kg}$, $J_0 = 0,75ma^2$
 $k_\Delta = 5EJ/3a^3$



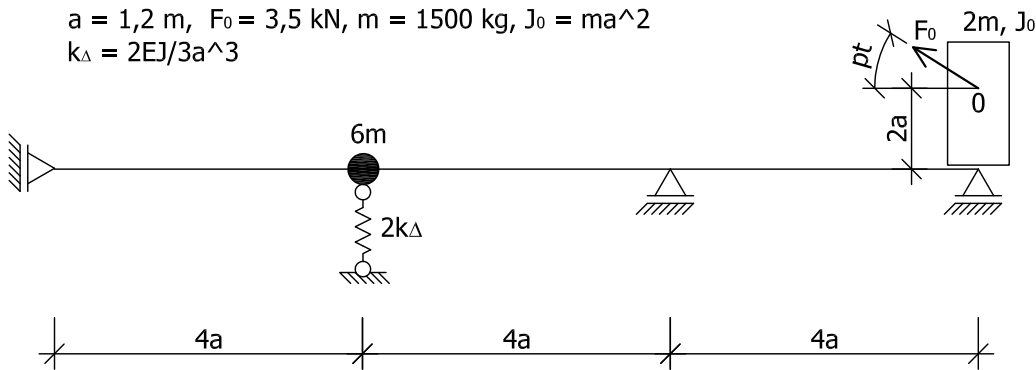
57

$a = 1,0 \text{ m}$, $F_0 = 3,5 \text{ kN}$, $m = 1800 \text{ kg}$, $J_0 = ma^2$
 $k_\Delta = 4EJ/3a^3$, $k_\phi = 5EJ/3a$



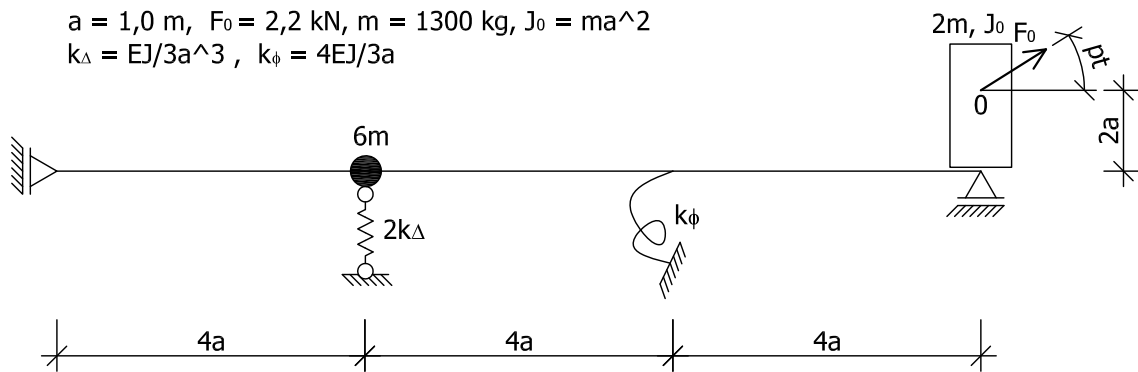
58

$a = 1,2 \text{ m}$, $F_0 = 3,5 \text{ kN}$, $m = 1500 \text{ kg}$, $J_0 = ma^2$
 $k_\Delta = 2EJ/3a^3$



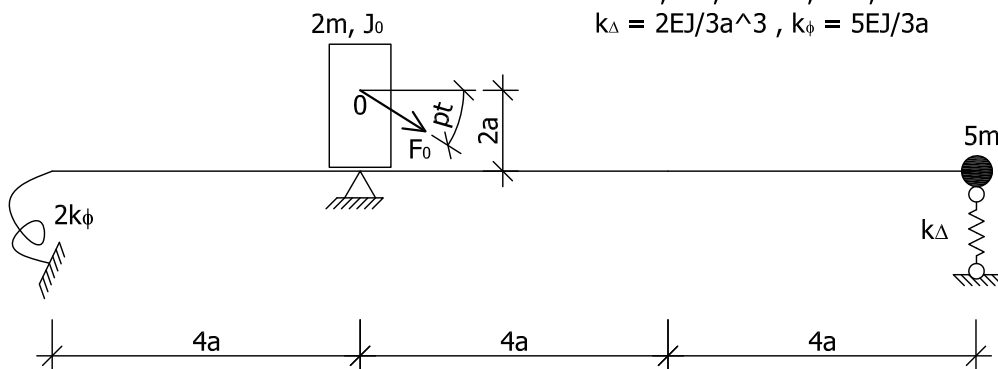
59

$a = 1,0 \text{ m}$, $F_0 = 2,2 \text{ kN}$, $m = 1300 \text{ kg}$, $J_0 = ma^2$
 $k_\Delta = EJ/3a^3$, $k_\phi = 4EJ/3a$



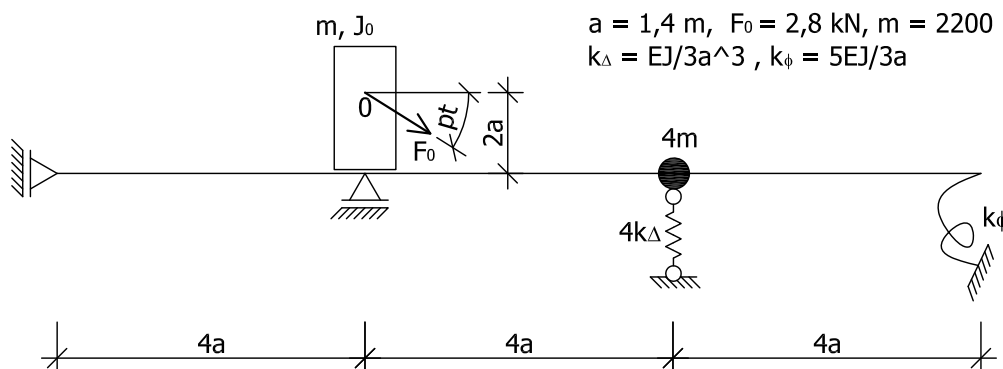
60

$a = 1,1 \text{ m}$, $F_0 = 3,4 \text{ kN}$, $m = 1500 \text{ kg}$, $J_0 = ma^2$
 $k_\Delta = 2EJ/3a^3$, $k_\phi = 5EJ/3a$



61

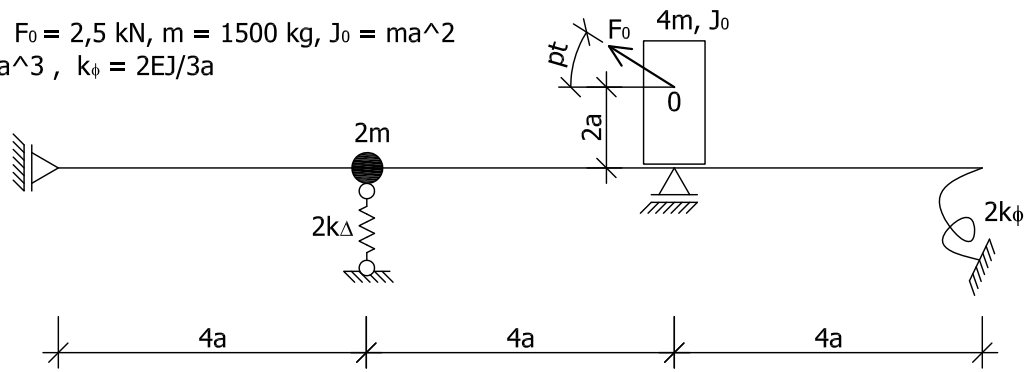
$a = 1,4 \text{ m}$, $F_0 = 2,8 \text{ kN}$, $m = 2200 \text{ kg}$, $J_0 = 0,5ma^2$
 $k_\Delta = EJ/3a^3$, $k_\phi = 5EJ/3a$



62

$$a = 1,2 \text{ m}, F_0 = 2,5 \text{ kN}, m = 1500 \text{ kg}, J_0 = ma^2$$

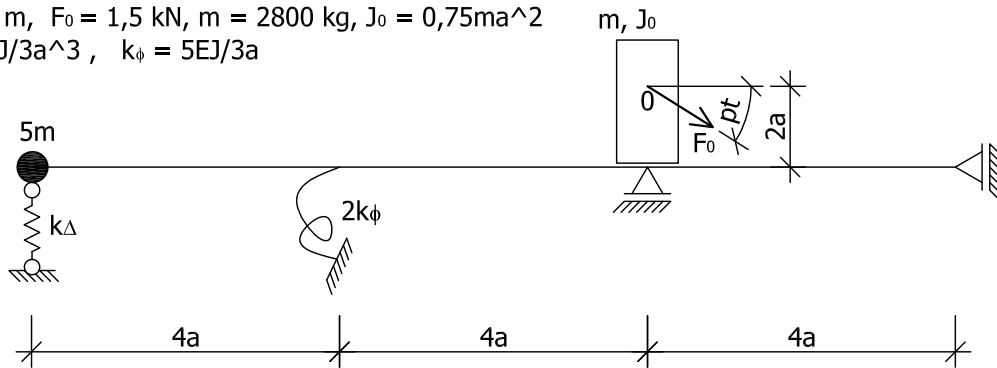
$$k_{\Delta} = 4EJ/3a^3, k_{\phi} = 2EJ/3a$$



63

$$a = 0,9 \text{ m}, F_0 = 1,5 \text{ kN}, m = 2800 \text{ kg}, J_0 = 0,75ma^2$$

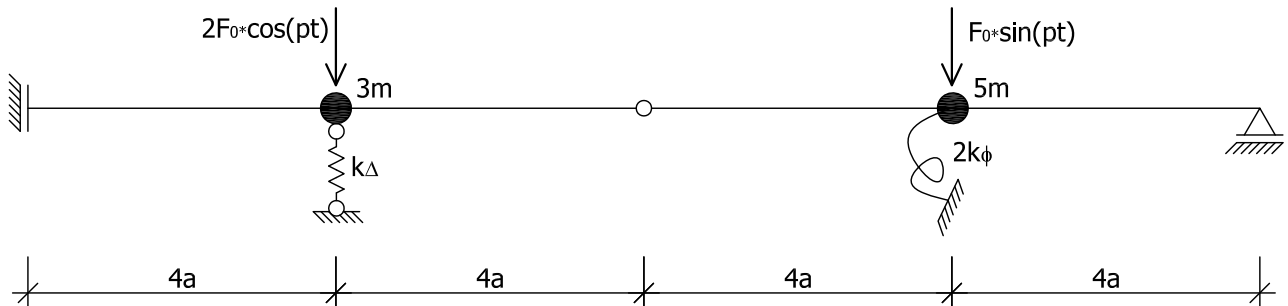
$$k_{\Delta} = 4EJ/3a^3, k_{\phi} = 5EJ/3a$$



64

$$a = 1,2 \text{ m}, F_0 = 3,5 \text{ kN}, m = 2400 \text{ kg},$$

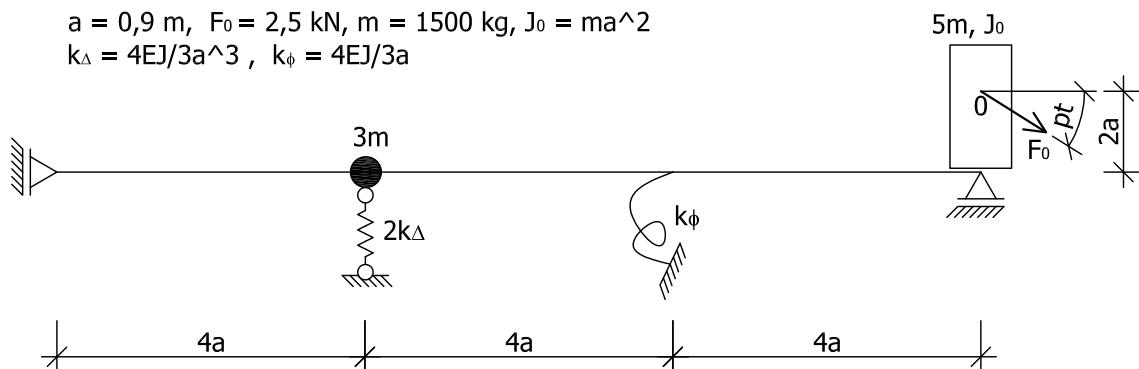
$$k_{\Delta} = 5EJ/3a^3, k_{\phi} = 2EJ/3a$$



65

$$a = 0,9 \text{ m}, F_0 = 2,5 \text{ kN}, m = 1500 \text{ kg}, J_0 = ma^2$$

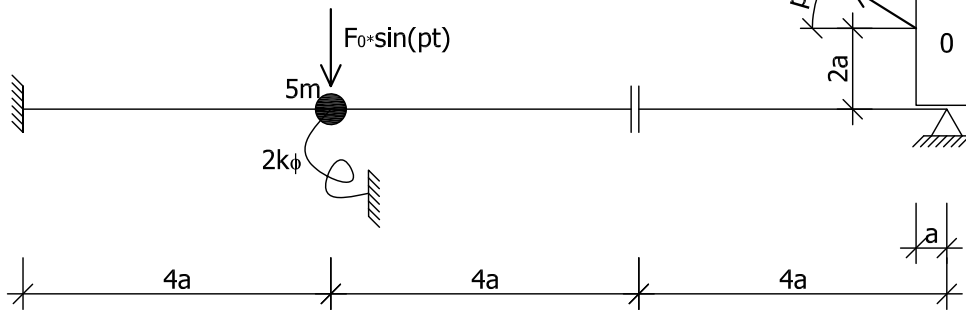
$$k_{\Delta} = 4EJ/3a^3, k_{\phi} = 4EJ/3a$$



66

$$a = 1,1 \text{ m}, F_0 = 3,2 \text{ kN}, m = 1800 \text{ kg}, J_0 = ma^2$$

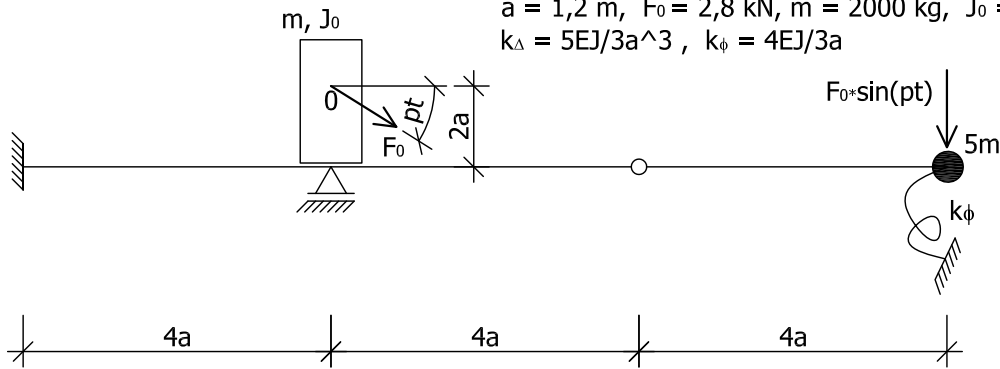
$$k_\phi = 2EJ/3a$$



67

$$a = 1,2 \text{ m}, F_0 = 2,8 \text{ kN}, m = 2000 \text{ kg}, J_0 = 0,75ma^2$$

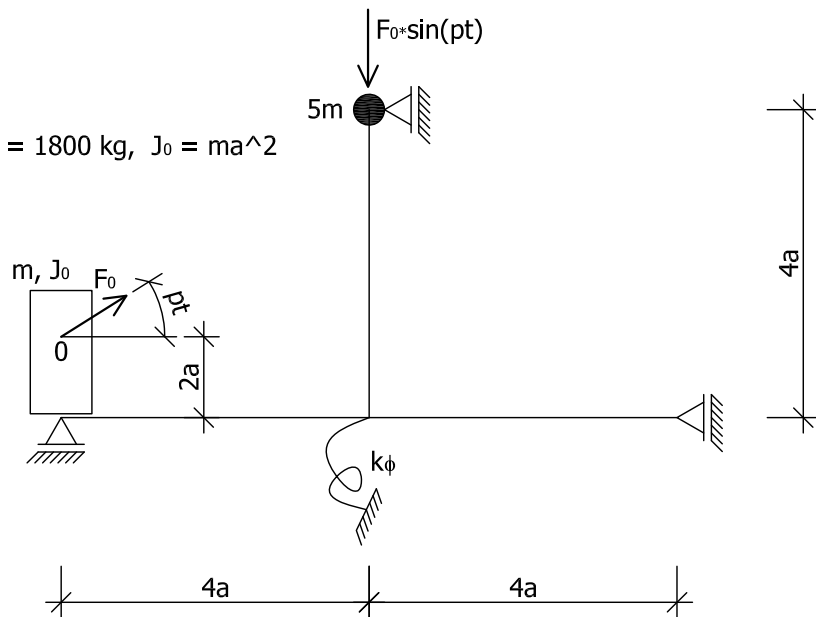
$$k_\Delta = 5EJ/3a^3, k_\phi = 4EJ/3a$$



68

$$a = 1,0 \text{ m}, F_0 = 3 \text{ kN}, m = 1800 \text{ kg}, J_0 = ma^2$$

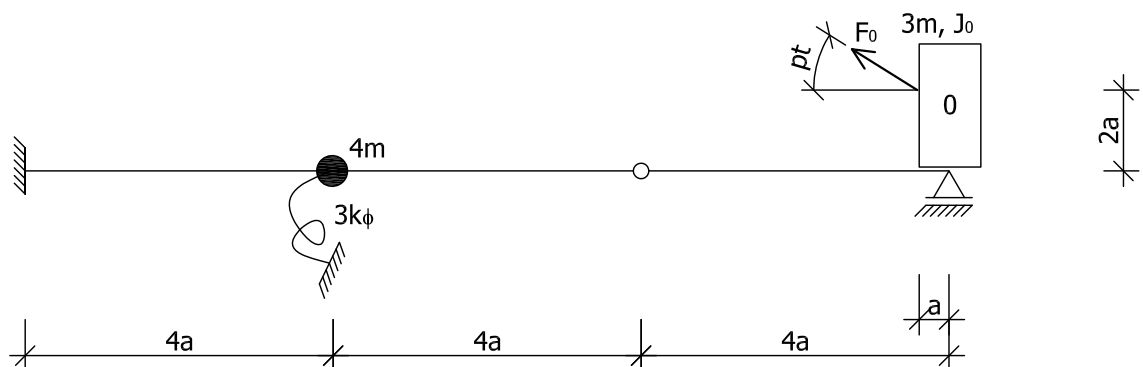
$$k_\phi = 2EJ/3a$$



69

$$a = 1,2 \text{ m}, F_0 = 2,5 \text{ kN}, m = 2200 \text{ kg}, J_0 = 0,5ma^2$$

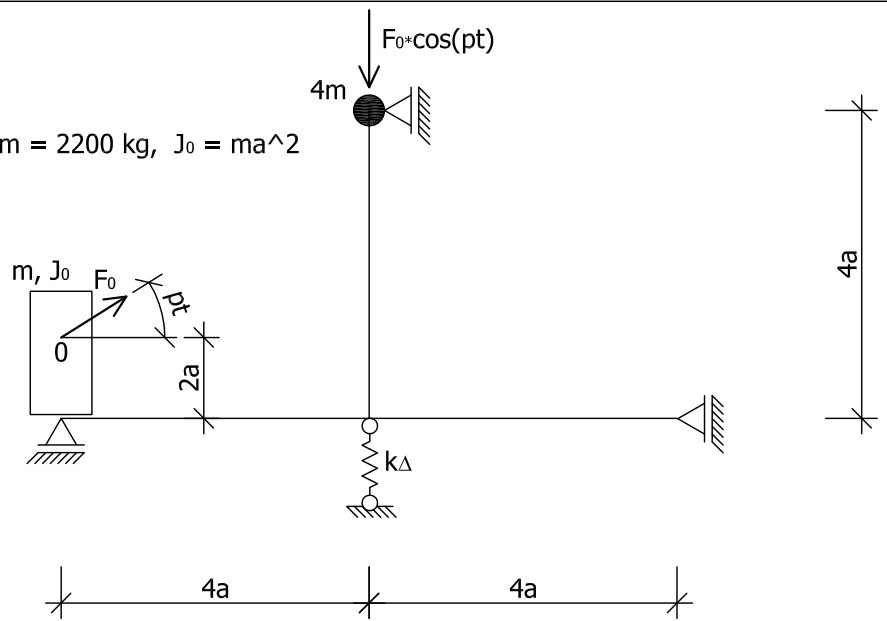
$$k_\Delta = 5EJ/3a^3, k_\phi = 4EJ/3a$$



70

$$a = 1,2 \text{ m}, F_0 = 2,5 \text{ kN}, m = 2200 \text{ kg}, J_0 = ma^2$$

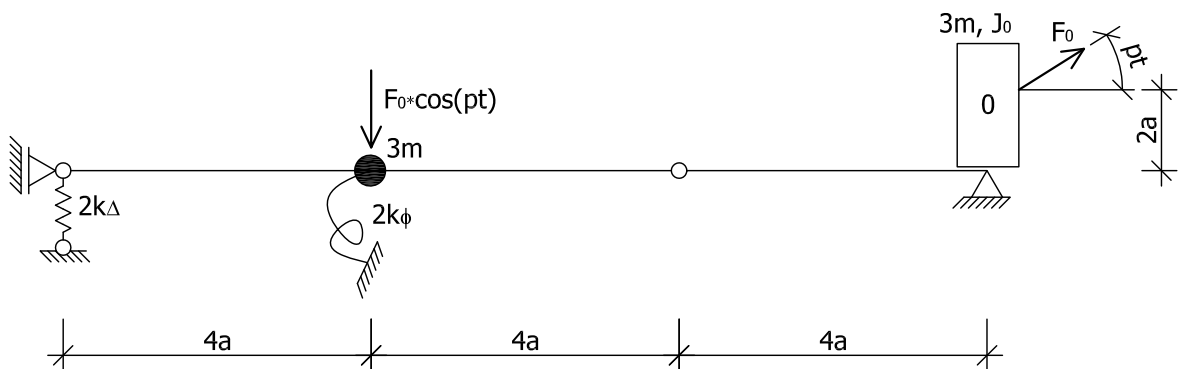
$$k_{\Delta} = 4EJ/3a^3$$



71

$$a = 1,1 \text{ m}, F_0 = 1,5 \text{ kN}, m = 1300 \text{ kg}, J_0 = 0,5ma^2$$

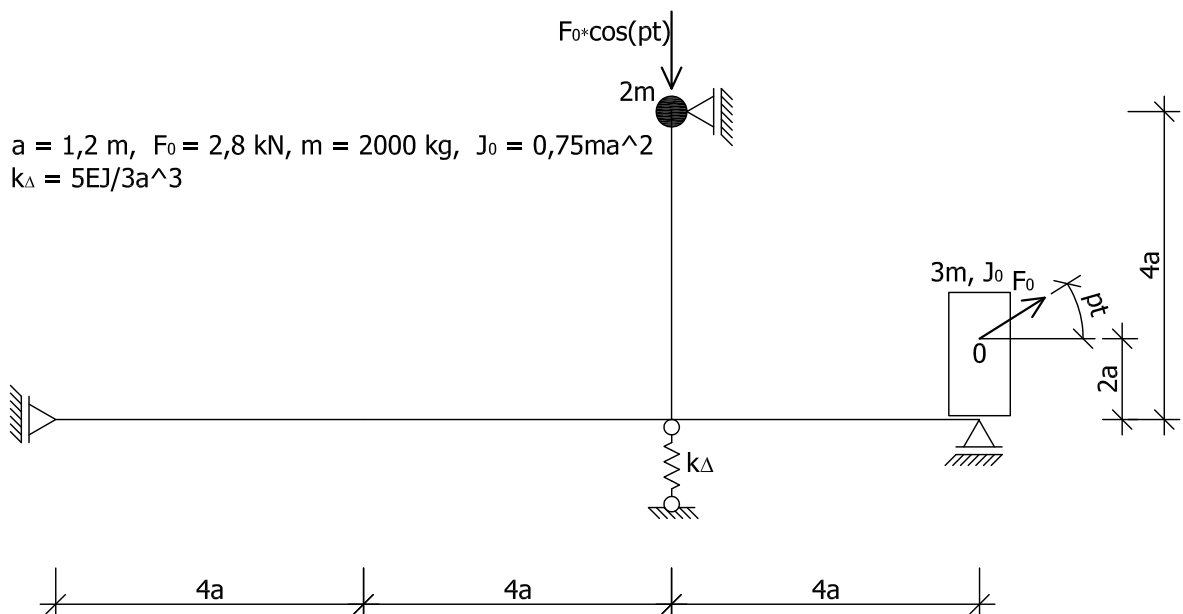
$$k_{\Delta} = 4EJ/3a^3, k_{\phi} = 2EJ/3a$$



72

$$a = 1,2 \text{ m}, F_0 = 2,8 \text{ kN}, m = 2000 \text{ kg}, J_0 = 0,75ma^2$$

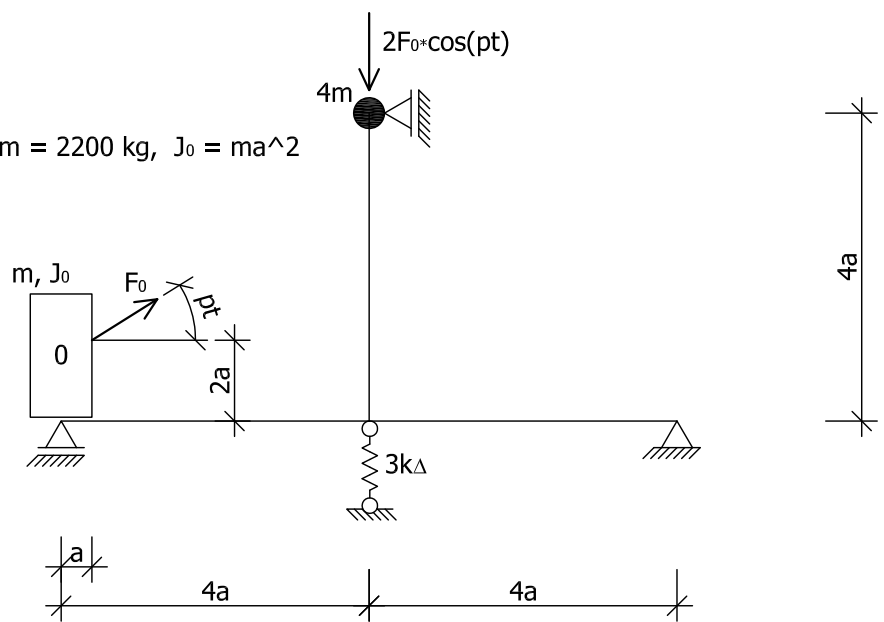
$$k_{\Delta} = 5EJ/3a^3$$



73

$$a = 1,2 \text{ m}, F_0 = 2,5 \text{ kN}, m = 2200 \text{ kg}, J_0 = ma^2$$

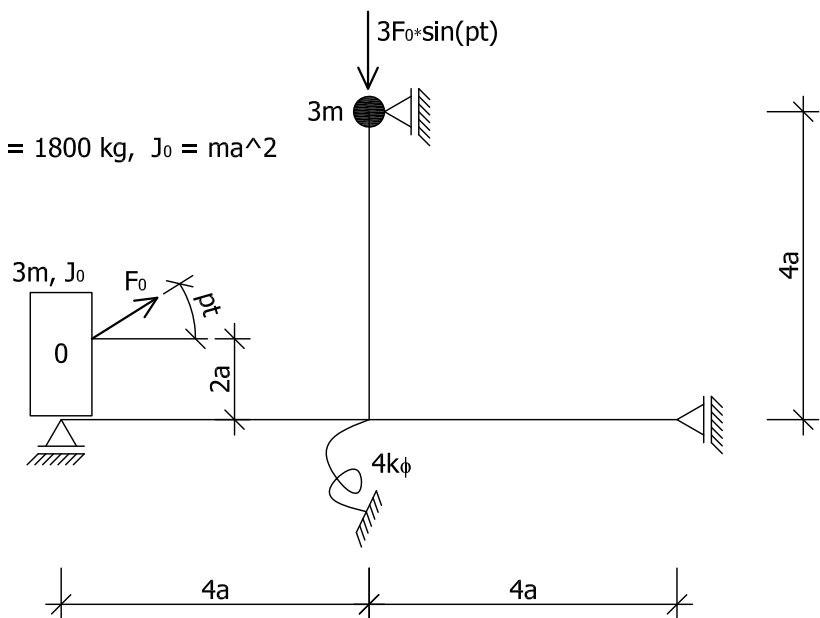
$$k_{\Delta} = 4EJ/3a^3$$



74

$$a = 1,0 \text{ m}, F_0 = 3 \text{ kN}, m = 1800 \text{ kg}, J_0 = ma^2$$

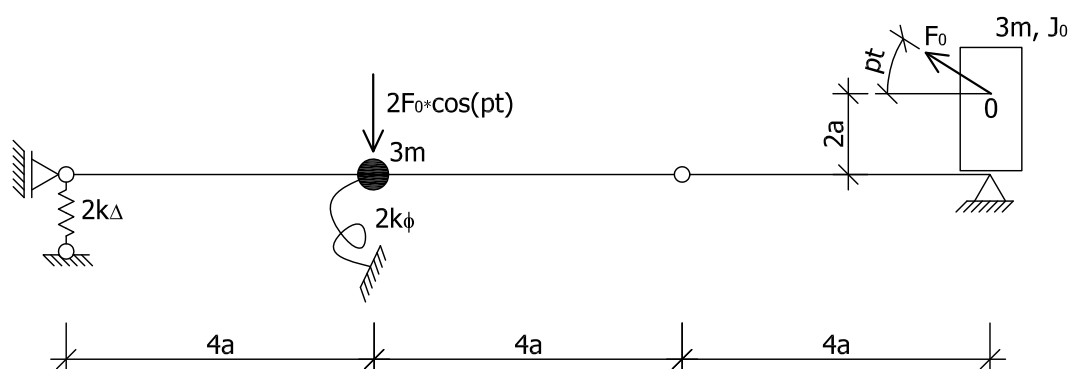
$$k_{\phi} = 2EJ/3a$$



75

$$a = 1,1 \text{ m}, F_0 = 4,5 \text{ kN}, m = 1700 \text{ kg}, J_0 = 0,75ma^2$$

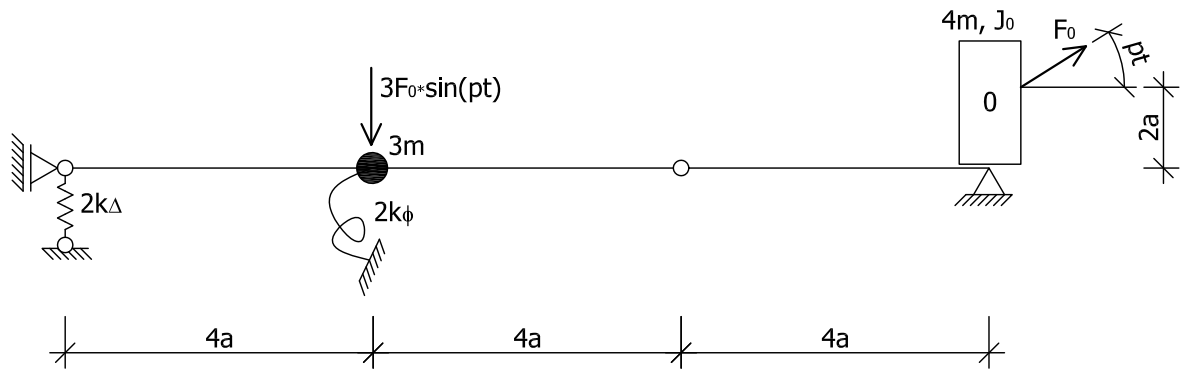
$$k_{\Delta} = 4EJ/3a^3, k_{\phi} = 2EJ/3a$$



76

$$a = 1,1 \text{ m}, F_0 = 1,5 \text{ kN}, m = 1300 \text{ kg}, J_0 = 0,5ma^2$$

$$k_\Delta = 4EJ/3a^3, k_\phi = 2EJ/3a$$



77

$$a = 1,0 \text{ m}, F_0 = 3 \text{ kN}, m = 1800 \text{ kg}, J_0 = ma^2$$

$$k_\phi = 2EJ/3a, p = 0,95\omega_1$$

