exercise session 5

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Wind Energy Systems, Summer-Semester 2018

Albert-Ludwigs-University, Freiburg, Germany

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1. questions from you for me
2. concept questions
3. homework

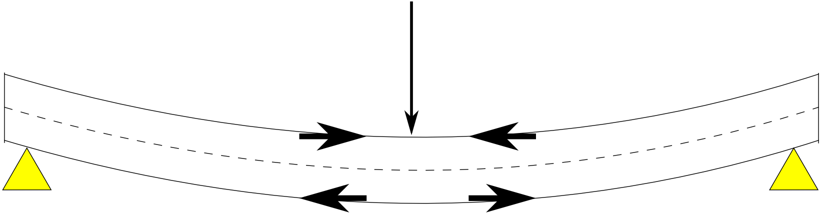
a friendly reminder

..."could [you] provide us a 'perfect solution' on the slides or on the blackboard" ?

the solutions are posted online = the 'perfect solution'
(suggested to read over the solutions and prepare questions before the last exercise session, over-next Wednesday.)

leftover from last week: the neutral axis

the neutral axis doesn't feel any internal compression or tension in whatever deformation state the beam is in.



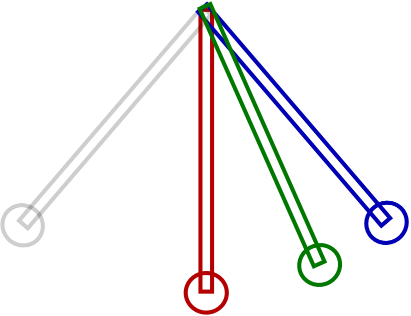
yes, if the beam deforms symmetrically, then:

neutral axis → neutral surface

let's play a game...

concept questions!

which equality motivates energy methods: pendulum



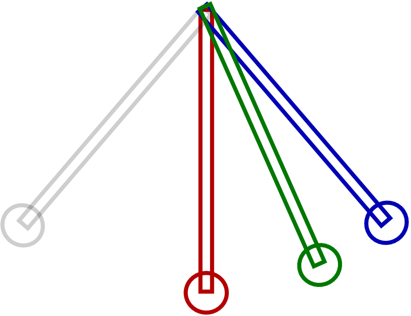
a) PE + KE = PE + KE

b) PE + KE = PE + KE

c) PE + KE = PE + KE

d) all of the above

which equality motivates energy methods: pendulum



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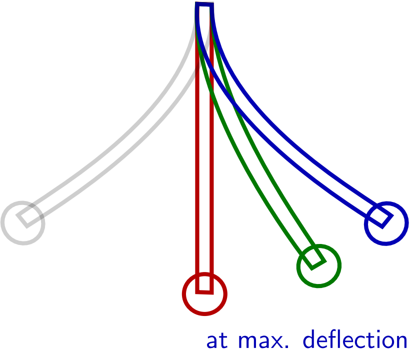
which equality motivates energy methods: beam deflection



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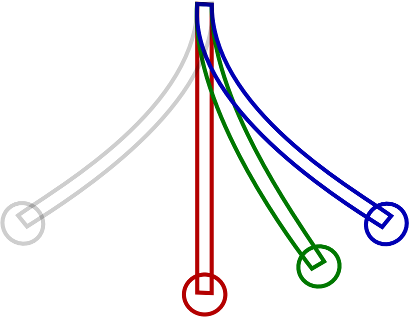
which equality motivates energy methods: beam deflection



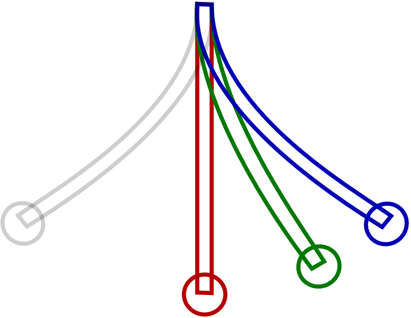
a) PE + KE = PE + KE

b) PE + KE = PE + KE

c) PE + KE = PE + KE

d) all of the above

what equality is most convenient: beam deflection



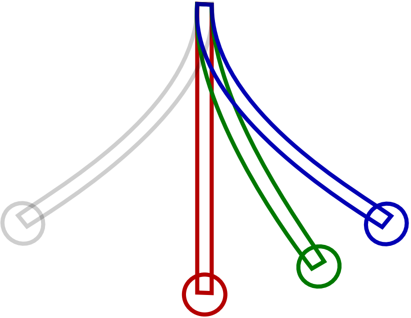
at max. deflection
assume negligible height differences

a) $\cancel{PE} + KE = \cancel{PE} + KE$

b) $PE + \cancel{KE} = \cancel{PE} + KE$

c) $\cancel{PE} + KE = PE + \cancel{KE}$

d) $PE + \cancel{KE} = PE + \cancel{KE}$



at max. deflection
assume negligible height differences

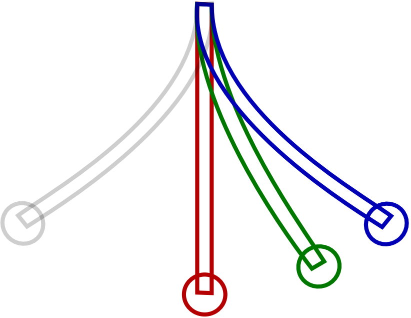
a) $\cancel{PE} + KE = \cancel{PE} + KE$

b) $PE + \cancel{KE} = \cancel{PE} + KE$

c) $\boldsymbol{\cancel{PE} + KE = PE + \cancel{KE}}$

d) $PE + \cancel{KE} = PE + \cancel{KE}$

which energy term is negligible?



at max. deflection
assume negligible height differences

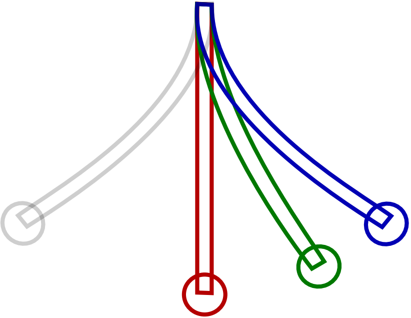
a) $\cancel{KE_{ball}} + KE_{beam}$
$= PE_{ball} + PE_{beam}$

b) $KE_{ball} + \cancel{KE_{beam}}$
$= PE_{ball} + PE_{beam}$

c) $KE_{ball} + KE_{beam}$
$= \cancel{PE_{ball}} + PE_{beam}$

d) $KE_{ball} + KE_{beam}$
$= PE_{ball} + \cancel{PE_{beam}}$

which energy term is negligible?



at max. deflection
assume negligible height differences

a) $\cancel{KE_{ball}} + KE_{beam} = PE_{ball} + PE_{beam}$

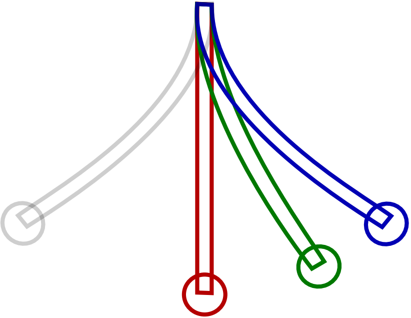
b) $KE_{ball} + \cancel{KE_{beam}} = PE_{ball} + PE_{beam}$

c) $\boldsymbol{KE_{ball} + KE_{beam} = \cancel{PE_{ball}} + PE_{beam}}$

d) $KE_{ball} + KE_{beam} = PE_{ball} + \cancel{PE_{beam}}$

with deflection $x(s,t) = A(s)\cos(\omega t)$, which expressions are correct?

such that: $\text{KE}_{ball} = \frac{1}{2} m_{ball} \dot{x}(L,t)^2$



at max. deflection
assume negligible height differences

a) $\text{PE}_{beam} = \frac{1}{2} k \int_0^L (x(s,t))\, \mathrm{d}s$
$\text{KE}_{beam} = \frac{1}{2} \frac{m_{beam}}{L} \int_0^L \left(\dot{x}(s,t)^2\right) \mathrm{d}s$

b) $\text{PE}_{beam} = \frac{1}{2} k \int_0^L \left(x(s,t)^2\right) \mathrm{d}s$
$\text{KE}_{beam} = \frac{1}{2} \frac{m_{beam}}{L} \int_0^L \left(\dot{x}(s,t)^2\right) \mathrm{d}s$

c) $\text{PE}_{beam} = \frac{1}{2} k \int_0^L (\dot{x}(s,t))\, \mathrm{d}s$
$\text{KE}_{beam} = \frac{1}{2} \frac{m_{beam}}{L} \int_0^L \left(x(s,t)^2\right) \mathrm{d}s$

d) $\text{PE}_{beam} = \frac{1}{2} k \int_0^L \left(\dot{x}(s,t)^2\right) \mathrm{d}s$
$\text{KE}_{beam} = \frac{1}{2} \frac{m_{beam}}{L} \int_0^L \left(x(s,t)^2\right) \mathrm{d}s$

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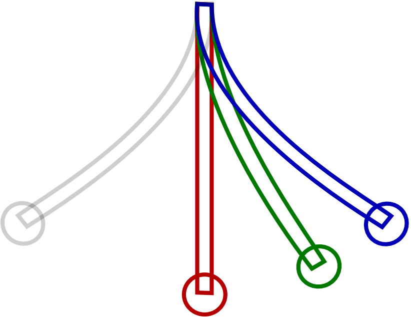

at max. deflection
assume negligible height differences

a) $\mathrm{PE}_{beam} = \frac{1}{2} k \int_0^L \left(x(s,t)\right) \mathrm{d}s$
$\mathrm{KE}_{beam} = \frac{1}{2} \frac{m_{beam}}{L} \int_0^L \left(\dot{x}(s,t)^2\right) \mathrm{d}s$

b) $\mathrm{PE}_{beam} = \frac{1}{2} k \int_0^L \left(x(s,t)^2\right) \mathrm{d}s$

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about the homework

1a		1a (contd)	
i	Jakob Salewsky	v	Mariana Ferrandon
ii	Yasaman Heshamtzadeh	vi	Deepak
iii	Irene	vii	Nils Straub
iv	Karima Saddedine		