Problem 3 Results

N = 2

Potential =

(A*E*((2*(u2 - u3)^2)/L + (2*u2^2)/L))/2 - A*P*u3 - A*q*((L*u2)/4 + (L*(u2 + u3))/4)

potential_dU2 =

(A*E*((2*(2*u2 - 2*u3))/L + (4*u2)/L))/2 - (A*L*q)/2

potential_dU3 =

- A*P - (A*L*q)/4 - (A*E*(2*u2 - 2*u3))/L

N = 4

Potential =

(A*E*((16*(u2 - u3)^2)/L + (16*(u3 - u4)^2)/L + (16*(u4 - u5)^2)/L + (16*u2^2)/L))/2 - A*P*(u4 + (8*(u4 - u5)*((3*L)/4 - x))/L) - A*q*((L*u2)/4 + (L*u3)/4 + (L*u4)/4 + (L*u5)/4)

potential_dU2 =

(A*E*((16*(2*u2 - 2*u3))/L + (32*u2)/L))/2 - (A*L*q)/4

potential_dU3 =

- (A*L*q)/4 - (A*E*((16*(2*u2 - 2*u3))/L - (16*(2*u3 - 2*u4))/L))/2

potential_dU4 =

- A*P*((8*((3*L)/4 - x))/L + 1) - (A*L*q)/4 - (A*E*((16*(2*u3 - 2*u4))/L - (16*(2*u4 - 2*u5))/L))/2

N = 8

Potential =

(A*E*((8*(u2 - u3)^2)/L + (8*(u3 - u4)^2)/L + (8*(u4 - u5)^2)/L + (8*(u6 - u7)^2)/L + (8*(u7 - u8)^2)/L + (8*(u8 - u9)^2)/L + (L*(9*u5 - 7*u6))/16 + (8*u2^2)/L))/2 - A*P*(u8 + (8*(u8 - u9)*((7*L)/8 - x))/L) - A*q*((L*u2)/16 - L*(3*u7 - 4*u8) + (3*L*(3*u8 - 4*u9))/4 + (L*(u2 + u3))/16 + (L*(u3 + u4))/16 + (L*(u4 + u5))/16 + (L*(u5 + u6))/16 + (L*(u6 + u7))/16)

potential_dU2 =

(A*E*((8*(2*u2 - 2*u3))/L + (16*u2)/L))/2 - (A*L*q)/8

potential_dU3 =

- (A*L*q)/8 - (A*E*((8*(2*u2 - 2*u3))/L - (8*(2*u3 - 2*u4))/L))/2

potential_dU4 =

- (A*L*q)/8 - (A*E*((8*(2*u3 - 2*u4))/L - (8*(2*u4 - 2*u5))/L))/2

potential_dU5 =

(A*E*((9*L)/16 - (8*(2*u4 - 2*u5))/L))/2 - (A*L*q)/8

potential_dU6 =

- (A*E*((7*L)/16 - (8*(2*u6 - 2*u7))/L))/2 - (A*L*q)/8

potential_dU7 =

(47*A*L*q)/16 - (A*E*((8*(2*u6 - 2*u7))/L - (8*(2*u7 - 2*u8))/L))/2

potential_dU8 =

- A*P*((8*((7*L)/8 - x))/L + 1) - (25*A*L*q)/4 - (A*E*((8*(2*u7 - 2*u8))/L - (8*(2*u8 - 2*u9))/L))/2

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clear;
clc;

n = 8; %input n = 2, 4, 8
u1 = 0;
syms u2 u3 u4 u5 u6 u7 u8 u9 u10 u11 u12 u13 u14 u15 u16 u17
syms L x A E q int1 fun1 P

if n == 2 % 2 segments
    function1 = u1 + ((u2 - u1)/(L/2))*x
    function2 = u2 + ((u3 - u2)/(L/2))*(x - (L/2))
    limit1 = 0
    limit2 = L/2
    limit3 = L/2
    limit4 = L
    %Part 1
    Du_dx_1 = diff(function1, x)
    Du_dx_2 = diff(function2, x)
    function1_1 = (Du_dx_1)^2;
    integrate1_1 = int(function1_1, x,limit1,limit2)
    function1_2 = (Du_dx_2)^2;
    integrate1_2 = int(function1_2, x, limit3, limit4)
    %Part 2
    function2_1 = function1
    intgrate2_1 = int(function2_1, x, limit1, limit2)
    function2_2 = function2
    integrate2_2 = int(function2_2, x, limit3, limit4)

    Potential = (A*E/2)*(integrate1_1 + integrate1_2) - A*q*(intgrate2_1 +
integrate2_2) - A*P*(u2 + ((u3 - u2)/(L/2))*(L - (L/2)))
    potential_dU2 = diff(Potential, u2)
    potential_dU3 = diff(Potential, u3)

elseif n == 4 % 4 segments
    function1 = u1 + ((u2 - u1)/(L/8))*x
    function2 = u2 + ((u3 - u2)/(L/8))*(x - (L/4))
    function3 = u3 + ((u4 - u3)/(L/8))*(x - (L/2))
    function4 = u4 + ((u5 - u4)/(L/8))*(x - (3*L/4))
    limit1 = 0
    limit2 = L/4
    limit3 = L/4
    limit4 = L/2
    limit5 = L/2
    limit6 = (3*L)/4
    limit7 = (3*L)/4
    limit8 = L
    %Part 1
    Du_dx_1 = diff(function1, x)
    Du_dx_2 = diff(function2, x)
    Du_dx_3 = diff(function3, x)
    Du_dx_4 = diff(function4, x)
    function1_1 = (Du_dx_1)^2;
    integrate1_1 = int(function1_1, x,limit1,limit2)
    function1_2 = (Du_dx_2)^2;
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    integrate1_2 = int(function1_2, x, limit3, limit4)
    function1_3 = (Du_dx_3)^2;
    integrate1_3 = int(function1_3, x, limit5, limit6)
    function1_4 = (Du_dx_4)^2;
    integrate1_4 = int(function1_4, x, limit7, limit8)
    %Part 2
    function2_1 = function1
    intgrate2_1 = int(function2_1, x, limit1, limit2)
    function2_2 = function2
    integrate2_2 = int(function2_2, x, limit3, limit4)
    function2_3 = function3
    integrate2_3 = int(function2_3, x, limit5, limit6)
    function2_4 = function4
    integrate2_4 = int(function2_4, x, limit7, limit8)

    Potential = (A*E/2)*(integrate1_1 + integrate1_2 + integrate1_3 +
integrate1_4) - A*q*(intgrate2_1 + integrate2_2 + integrate2_3 +
integrate2_4) - A*P*(u4 + ((u5 - u4)/(L/8))*(x - (3*L/4)))
    potential_dU2 = diff(Potential, u2)
    potential_dU3 = diff(Potential, u3)
    potential_dU4 = diff(Potential, u4)
elseif n == 8 % 8 segments
    function1 = u1 + ((u2 - u1)/(L/8))*x
    function2 = u2 + ((u3 - u2)/(L/8))*(x - (L/8))
    function3 = u3 + ((u4 - u3)/(L/8))*(x - (L/4))
    function4 = u4 + ((u5 - u4)/(L/8))*(x - (3*L/8))
    function5 = u5 + ((u6 - u5)/(L/8))*(x - (L/2))
    function6 = u6 + ((u7 - u6)/(L/8))*(x - (5*L/8))
    function7 = u7 + ((u8 - u7)/(L/8))*(x - (3*L/4))
    function8 = u8 + ((u9 - u8)/(L/8))*(x - (7*L/8))
    limit1 = 0
    limit2 = L/8
    limit3 = L/8
    limit4 = L/4
    limit5 = L/4
    limit6 = (3*L)/8
    limit7 = (3*L)/8
    limit8 = L/2
    limit9 = L/2
    limit10 = (5*L)/8
    limit11 = (5*L)/8
    limit12 = (3*L)/4
    limit13 = (3*L)/4
    limit14 = (7*L)/4
    limit15 = (7*L)/4
    limit16 = L
    %Part 1
    Du_dx_1 = diff(function1, x)
    Du_dx_2 = diff(function2, x)
    Du_dx_3 = diff(function3, x)
    Du_dx_4 = diff(function4, x)
    Du_dx_5 = diff(function5, x)
    Du_dx_6 = diff(function6, x)
    Du_dx_7 = diff(function7, x)
    Du_dx_8 = diff(function8, x)
    function1_1 = (Du_dx_1)^2;
    integrate1_1 = int(function1_1, x,limit1,limit2)
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function1_2 = (Du_dx_2)^2;
integrate1_2 = int(function1_2, x, limit3, limit4)
function1_3 = (Du_dx_3)^2;
integrate1_3 = int(function1_3, x, limit5, limit6)
function1_4 = (Du_dx_4)^2;
integrate1_4 = int(function1_4, x, limit7, limit8)
function1_5 = (Du_dx_5)^2;
integrate1_5 = int(function5, x,limit1,limit2)
function1_6 = (Du_dx_6)^2;
integrate1_6 = int(function1_6, x, limit3, limit4)
function1_7 = (Du_dx_7)^2;
integrate1_7 = int(function1_7, x, limit5, limit6)
fununction1_8 = (Du_dx_8)^2;
integrate1_8 = int(fununction1_8, x, limit7, limit8)
%Part 2
function2_1 = function1
intgrate2_1 = int(function2_1, x, limit1, limit2)
function2_2 = function2
integrate2_2 = int(function2_2, x, limit3, limit4)
function2_3 = function3
integrate2_3 = int(function2_3, x, limit5, limit6)
function2_4 = function4
integrate2_4 = int(function2_4, x, limit7, limit8)
function2_5 = function5
integrate2_5 = int(function2_5, x, limit9, limit10)
function2_6 = function6
integrate2_6 = int(function2_6, x, limit11, limit12)
function2_7 = function7
integrate2_7 = int(function2_7, x, limit13, limit14)
function2_8 = function8
integrate2_8 = int(function2_8, x, limit15, limit16)

    Potential = (A*E/2)*(integrate1_1 + integrate1_2 + integrate1_3 +
integrate1_4 + integrate1_5 + integrate1_6 + integrate1_7 + integrate1_8) -
A*q*(intgrate2_1 + integrate2_2 + integrate2_3 + integrate2_4 + integrate2_5
+ integrate2_6 + integrate2_7 + integrate2_8) - A*P*(u8 + ((u9 -
u8)/(L/8))*(x - (7*L/8)))
    potential_dU2 = diff(Potential, u2)
    potential_dU3 = diff(Potential, u3)
    potential_dU4 = diff(Potential, u4)
    potential_dU5 = diff(Potential, u5)
    potential_dU6 = diff(Potential, u6)
    potential_dU7 = diff(Potential, u7)
    potential_dU8 = diff(Potential, u8)
end
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