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OEMP 3 Group 2 Part 4

Group 11, 10:40 Lab

Code by: Ian Faber and Nathan Evans

```
clear; clc; close all;
```

Constants

```
w0 = 2001/12; % lb/in
L = 27.25*12; % in

maxDim = 1*12; % in

%density and sigma
rhovec = [.098, .283, .304, .284, .16];
sigmaYieldvec = [35, 70, 35, 115, 120] .* 1000;
price = [8.03, 8.07, 52.78, 29.63, 115.36];
Material = ["Aluminum 6061", "Steel 4130", "Nickel Inconel
 600", "Stainless Steel 17-4", "Titanium 6AL-4V"];
```

Hollow Square

```
for i = 1:5

    rho = rhovec(i);
    sigmaYield = sigmaYieldvec(i);
    moment = @(A, x) (w0/2)*(((-x^3)/(3*L)) + x^2 - L*x + (L^2)/2) -
 (rho* A * (L-x)^2)/2;

    inertiaCircle = @(r) (pi*r^4)/4;
    inertiaRectangle = @(b, h) (1/12)*b*h^3;

    bendingStress = @(M, y, I) (M*y)/I;

    factorOfSafety = @(sigmaYield, sigmaApplied) sigmaYield/
sigmaApplied;

    maxX = @(A) 0;%-L*(2*A*rho - w0)/w0;

    factors.shape = [];
    factors.area = [];
```

```
    factors.factorOfSafety = [];
for k = 1:4*maxDim % 1/4 in to 12 in length
    for l = 1:4*maxDim % 1/4 in to 12 in height
        for m = 1:4*(maxDim/2) % 1/4 in to 6 in wall thickness
            b = k/4;
            h = l/4;
            t = m/4;

            if(t >= b/2 || t >= h/2)
                break;
            end

            b1 = t;
            b2 = b - (2*t);
            h1 = h;
            h2 = t;

            area1 = b1*h1;
            area2 = b2*h2;
            area = 2*area1 + 2*area2;

            inertia = ((h1^4)/12)-(((h1-2*h2)^4)/12);

            x = maxX(area);

            sigmaBend = bendingStress(moment(area, x), h/2, inertia);
            factorHollow = factorOfSafety(sigmaYield, sigmaBend);

            if(factorHollow >= 1.5 && factorHollow <= 1.53)
                description = sprintf("hollow square, b = %.3f, h =
 %.3f, t = %0.3f", b, h, t);
                factors.shape = [factors.shape; description];
                factors.area = [factors.area; area];
                factors.factorOfSafety = [factors.factorOfSafety;
 factorHollow];
            end
        end
    end
end
hollow = factors;
hollowBeamResult = struct2table(hollow);
hollowBest = find(hollow.area == min(hollow.area));
hollowFinal = hollowBeamResult(hollowBest,:);
volume = hollowFinal.area * L;
weight = volume * rho;
hollowFinal.cost = weight * price(i);
hollowFinal.material = Material(i)
end


hollowFinal =

  1×5 table
```

```
                              shape                              area
factorOfSafety    cost        material
    ________________________________________________    _____
______________    _____    ______________

"hollow square, b = 3.750, h = 11.250, t = 1.750"    40.25
1.5153        10358    "Aluminum 6061"

hollowFinal =

  1×5 table

                              shape                              area
factorOfSafety    cost       material
    ________________________________________________    ____
______________    _____    ____________

"hollow square, b = 5.000, h = 10.500, t = 0.750"     21
1.5014        15683    "Steel 4130"

hollowFinal =

  1×5 table

                              shape                              area
factorOfSafety       cost            material
    ________________________________________________    ____
______________    __________    ____________________

"hollow square, b = 3.250, h = 11.250, t = 1.500"    34.5
1.515         1.8101e+05    "Nickel Inconel 600"

hollowFinal =

  1×5 table

                             shape                              area
factorOfSafety    cost           material
    _______________________________________________    ______
______________    _____    ______________________

"hollow square, b = 2.750, h = 8.500, t = 0.750"    14.625
1.5008        40243    "Stainless Steel 17-4"

hollowFinal =

  1×5 table

                             shape                              area
factorOfSafety    cost         material
```

```
"hollow square, b = 1.750, h = 8.500, t = 0.750"    13.125
1.5265         79218    "Titanium 6AL-4V"
```

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