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## OEMP 3 Group 2 Part 4

Group 11, 10:40 Lab

Code by: 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];
```

## 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) -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 = 2*(inertiaRectangle(b1, h1) + area1*(b-(t/2))^2
+ inertiaRectangle(b2, h2) + area2*(h-(t/2))^2);

        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 = %.3f", b, h, t);
            factors.shape = [factors.shape; description];
            factors.area = [factors.area; area];
            factors.factorOfSafety = [factors.factorOfSafety;
factorHollow];
        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;
cost = weight * price(i)
end

hollowFinal =

    1x3 table

    shape          area
    factorOfSafety

```

---

---

"hollow square, b = 7.750, h = 1.000, t = 0.250"	4.125
1.5031	

cost =

1.0615e+03

hollowFinal =

1×3 table

	shape	area
factorOfSafety		

---

"hollow square, b = 5.250, h = 1.500, t = 0.250"	3.125
1.529	

cost =

2.3338e+03

hollowFinal =

1×3 table

	shape	area
factorOfSafety		

---

"hollow square, b = 7.750, h = 1.000, t = 0.250"	4.125
1.5031	

cost =

2.1643e+04

hollowFinal =

1×3 table

	shape	area
factorOfSafety		

---

```

    "hollow square, b = 4.000, h = 1.500, t = 0.250"    2.5
1.519

cost =

    6.8792e+03

hollowFinal =

    1x3 table

    shape    area
factorOfSafety
    "hollow square, b = 4.000, h = 1.250, t = 0.250"    2.375
1.5106

cost =

    1.4335e+04

```

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