BIL113E

FINAL EXAM

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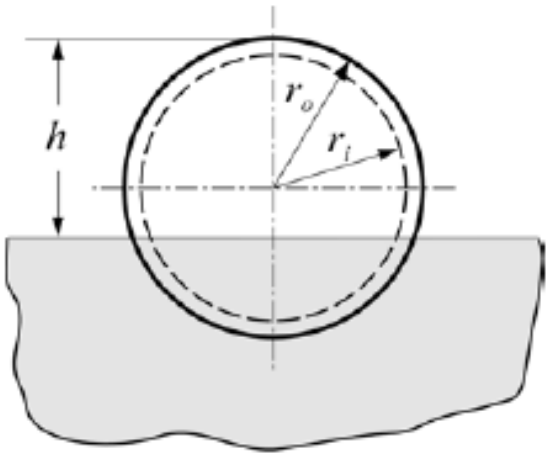
Q.1.(55p)An aluminum sphere in the water as shown below , has the radius of 60 cm (it means $r_o = 0.6m$) and the wall thickness of 12 mm (it means $r_i = 0.588m$). The density of aluminum is $\rho_{Al} = 2690\,\frac{kg}{m^3}$ and the density of the water is $\rho_{wtr} = 1030\,\frac{kg}{m^3}$. Determine the height *h* using a Matlab program.



The weight of the sphere is $W_{sph} = \rho_{Al}\frac{4}{3}\pi(r_o^3 - r_i^3)g$ (1)

The weight of the water is $W_{wtr} = \rho_{wtr}\frac{1}{3}\pi(2r_0 - h)^2(r_0 + h)g$ (2)

Instruction: Equalize (1) and (2) to obtain the polynomial according to *h*. You must choose the logical result(If you have Matlab on your computer).

Bir alüminyum cisim şekilde görüldüğü gibi suyun içinde dengededir. Parametrelere ait gerekli sayısal değerler yukarıda verilmiştir. Buna göre *h* yüksekliğini hesaplayan bir Matlab programı yazın.

Yol Gösterme: (1) ve (2) denklemlerini eşitleyerek h ya bağlı bir polinom elde edebilirsiniz. Seçeceğiniz sonuç mantıklı olmalıdır (Matlab bilgisayarında yüklü olanlar için)

Solution of Question 1:

```
syms h
roAl = 2690; roWater = 1030; rOut = 0.6; rIn = 0.588; g = 9.81;
weightSphere = roAl*(4/3)*pi*(rOut^3 - rIn^3)*g;
weightWater = roWater*(1/3)*pi*((2*rOut - h)^2)*(rOut + h)*g;
eqn = weightSphere == weightWater;
[solh] = solve(eqn,h);
[solh] = double(solh);
for i = 1:1:3
    if rIn < solh(i,1) && solh(i,1) < 2*rOut
        solution = solh(i,1);
    end
end
fprintf('Height of sphere where is out of water
is %.4f\n',solution);
```

- **Output:**

```
Command Window
>> finalQ1
Height of sphere where is out of water is 0.9029
```

Q.2. (45p) Plot the solution of diferantial equation given below, for y(1)=2, x(0)=4 and x(f)=8. (Use ODE function).

$$\frac{dy}{dx} = 2e^x + cosx$$

Yukarıdaki diferansiyel denklemin verilen sayısal değerler için çözüm grafiğini elde eden bir program yazın.

Answer of Question 2:

```
[x,y] = ode45(@(x,y)2*exp(1)^x + cos(x),[4,8],2);
plot(x,y,'b');
title('dy/dx=2e^x+cosx');
xlabel('x');ylabel('y');
grid on;
```

- **Output:**