

April 25, 2021

```
[1]: import math as m
    ###3.1.1
    #///    ///
    a=1*1e-3
    =1.7*1e-3
    D =30*1e-3
    h=10*1e-3
    B =0.5
    Dm=D -a
    k=0.3
    0=m.pi*4*1e-7
    #///    ///

    ###3.2.1

    Sm=m.pi*Dm**2/4
    S =h*m.pi*D
    Sm_S =Sm/S
    Bm=B *1/Sm_S *(1+k)
    print(' Sm= %.3e\n' %Sm, 'S = %.3e\n' %S, 'Sm/S = %.3e\n' %Sm_S, 'Bm= %.3e\n' %Bm)

    Hm=55*1e3
    Bm_Hm=Bm/Hm
    print(' Bm_Hm= %.3e\n' %Bm_Hm)
    Lm=Bm_Hm*( /( 0*(1+k))) *Sm_S

    print(' Lm= %.3e\n' %Lm, 'Dm= %.3e\n' %Dm)

    Sm= 6.605e-04
    S = 9.425e-04
    Sm/S = 7.008e-01
    Bm= 9.275e-01

    Bm_Hm= 1.686e-05

    Lm= 1.230e-02
    Dm= 2.900e-02
```

```
[2]: #
Bm=0.95 #
Hm=32*1e3 #
Dm=m.sqrt((B*4*D*h*(1+k))/(Bm))
Dm=18*1e-3 #
Sm=m.pi*Dm**2/4
Sm_S=Sm/S
Bm_Hm=Bm/Hm
Lm=Bm_Hm*(/(0*(1+k)))*Sm_S
print(' Lm= %.3e\n' %Lm,'Dm= %.3e\n' %Dm,'Sm_S = %.3e\n' %Sm_S )

Lm= 1.472e-02
Dm= 1.800e-02
Sm_S = 5.400e-01
```

```
[4]: ###3.2.2
Bm_Hm= 0*(1+k)*S /Sm*Lm/
Hm2=20*1e3 # y
Bm2=Bm_Hm*Hm2
#
Bm_izm=0.97
Hm_izm=31*1e3
 $\phi$ m=Bm*Sm #
 $\phi$  =B *S
B = $\phi$  /S
print('  $\phi$ m= %.3e\n' % $\phi$ m,' $\phi$  = %.3e\n' % $\phi$  ,'B = %.3e\n' %B )

 $\phi$ m= 2.417e-04
 $\phi$  = 1.885e-04
B = 4.000e-01
```

```
[2]: import math as m
###4.1.1
#/// ///
a=5
b=5
c=15
d=0.1
h=25
S0=80
Fizm=15
f=a
#/// ///
d0=0.2
d1=0.22
lamb=1.5
```

```
eps=3
0=m.pi*4*1e-7
```

```
[3]: f0_list=[0.6,0.55,0.5]
f0=f0_list[0] # ( )
w=m.ceil(4*f0*(c-eps-2*lamb)*(h-lamb-f)/(m.pi*d1**2)) # ,
↪
print('w= ', '%.0f'%w)
```

w= 2629

```
[4]: Omax1=d /0.15 # 1
Omin1=d /0.2
print(' Omin1=', Omin1, '\n Omax1=', '%.3f'% Omax1)

Omin2=a*0.1 # 2
Omax2=a*0.2
print('\n Omin2=', Omin2, '\n Omax2=', Omax2)
```

Omin1= 0.5
Omax1= 0.667

Omin2= 0.5
Omax2= 1.0

```
[6]: # ,
min = 1e10
if Omin1< Omin2:
    0=round( Omin2,2)
else:
    0=round( Omin1,2)
print(' 0=', 0)
print(' 0, ')
0=0.5
print(' 0=', 0)
```

0= 0.5

0,

0= 0.5

```
[7]: Omax= 0+d #
Omin= 0-d
print(' Omax=', Omax, '\n Omin=', Omin)
```

Omax= 0.6
Omin= 0.4

```

[8]: def x_ ( 0, 0max= 0max,w=w,k1=1):
    global Ze_max,Ze_min
    global I_min,Gb4_max,Gb4_min,I_max
    #4.1.3.2.
    #
    B=0.2 #0,3
    #
    #
    X_=c/2
    print('X_=',X_)
    #
    #
    print(' 0=', 0)
    print('X_/ 0=',X_/ 0)

    #
    Zb_max=X_/ 0 /1.3
    print('Zb_max=',Zb_max)
    Zb=Zb_max* 0
    print('Zb=',Zb)
    Z_a=a
    print('Z_a=',Z_a)
    Z__b=Z_a
    print('Z__b=',Z__b)
    x__max= Z__b/ 0*1.3
    x__=x__max* 0
    print('x__=', '%.3f'%x__)
    #
    m1=(Z__b+(x__ - 0/2))/2
    m2=(Zb+(X_ - 0))/2
    print('m1=%f'%m1, '\nm2=%f'%m2)

    G1= 0*((2*b*1e-3)/(m.pi*(( /m2)+0.5)))
    print('\n\nG1=', '%.3f e-9'%(G1*1e9))

    G2= 0*0.52*b*1e-3
    G3= 0*(a*b*1e-3/ 0)
    G4= 0*0.26*b*1e-3
    print('G2=', '%.3f e-9'%(G2*1e9))
    print('G3=', '%.3f e-9'%(G3*1e9))
    print('G4=', '%.3f e-9'%(G4*1e9))

    G5= 0*((2*b*1e-3)/(m.pi*(( 0/m1)+1)))
    print('m1=',m1, '\n\nG5=', '%.3fe-9'%(G5*1e9))
    #
    G6= 0*0.077* 0*1e-3

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G7= 0*m1*1e-3/4
G8=2*G6+2*G7
print('G6=', '%.3f e-9'%(G6*1e9))
print('G7=', '%.3f e-9'%(G7*1e9))
print('G8=', '%.3f e-9'%(G8*1e9))

Gb4=G1+G2+G3+3*(G4+G5)+2*(G6+G7+G8)
print('\nGb4=', '%.3f e-9'%(Gb4*1e9))

Rb4=1/Gb4
print('\nRb4=', '%.3f e6'%(Rb4*1e-6))

Gb2=G1+G2+G3+2*(G4+G5+G8)
print('\nGb2=', '%.3f e-9'%(Gb2*1e9))
Rb2=1/Gb2
print('\nRb2=', '%.3f e6'%(Rb2*1e-6))

R_ms=Rb4*2

print('\nR_ms=', '%.3f e6'%(R_ms*1e-6))
#4.1.3.3.
ro=0.0174

#lsr=2*(2*(c-eps-lamb)/k1+3*a+2*eps+4*lamb) # -
lsr=4*(h+lamb)/k1+2*eps # -

q=m.pi*d0**2/4
ow=2*m.pi*50
Ra_r=ro*lsr*1e-3*w/q
Ra_im=ow*w**2/R_ms
Ze=(Ra_r**2+Ra_im**2)**0.5
if 0== 0max:
    Ze_min=(Ra_r**2+Ra_im**2)**0.5
    print('\nZe_min= %.2f e3'%(Ze_min*1e-3))
else:
    Ze_max=(Ra_r**2+Ra_im**2)**0.5
    print('\nZe_max= %.2f e3'%(Ze_max*1e-3))
print('lsr=%.2f'%lsr)

print('\nRa_r=%.2f'%Ra_r)
print('Ra_im=%.2f'%Ra_im)

#4.1.3.4.
I=(B*2*a*b*R_ms*10**(-6))/(w*(2**0.5))
print('I= %f'%I)
j=I/q

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print('j<=2..2.5 j= %.2f'%j)
U=I*Ze
print('U= %.2f'%U)
if 0== 0max:
    I max=I
    Gb4_max=Gb4
else:
    I min=I
    Gb4_min=Gb4

```

```

[9]: x_ ( 0= 0max)
print('\n\n\n\n\n')
x_ ( 0= 0min)
print('dZe=%.2e'%(Ze_max-Ze_min))

```

```

X_ = 7.5
0= 0.6
X_/ 0= 12.5
Zb_max= 9.615384615384615
Zb= 5.769230769230769
Z_a= 5
Z__b= 5
x__= 6.500
m1=5.600000
m2=6.334615

```

```

G1= 7.996 e-9
G2= 3.267 e-9
G3= 52.360 e-9
G4= 1.634 e-9
m1= 5.6

```

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G5= 3.613e-9
G6= 0.058 e-9
G7= 1.759 e-9
G8= 3.635 e-9

```

```

Gb4= 90.267 e-9

```

```

Rb4= 11.078 e6

```

```

Gb2= 81.385 e-9

```

```

Rb2= 12.287 e6

```

R_ms 22.157 e6

Ze_min= 0.19 e3

lsr=112.00

Ra_r=163.08

Ra_im=98.00

I= 0.059593

j<=2..2.5 j= 1.90

U= 11.34

X_ = 7.5

0= 0.4

X_/ 0= 18.75

Zb_max= 14.423076923076923

Zb= 5.76923076923077

Z_a= 5

Z__b= 5

x__= 6.500

m1=5.650000

m2=6.434615

G1= 7.996 e-9

G2= 3.267 e-9

G3= 78.540 e-9

G4= 1.634 e-9

m1= 5.65

G5= 3.736e-9

G6= 0.039 e-9

G7= 1.775 e-9

G8= 3.627 e-9

Gb4= 116.793 e-9

Rb4= 8.562 e6

Gb2= 107.796 e-9

Rb2= 9.277 e6

R_ms 17.124 e6

```

Ze_max= 0.21 e3
lsr=112.00

Ra_r=163.08
Ra_im=126.80
I= 0.046058
j<=2..2.5 j= 1.47
U= 9.51
dZe=1.63e+01

```

```

[10]: dZe=Ze_max-Ze_min
      print('dZe=%e'%dZe)
      S=dZe/(2*d )
      print('S=%e'%S)
      print('S0=%e'%S0)
      k1=(S/S0)**0.5
      print('k1=%f'%k1)
      w_new=w/k1
      print('w_new=%f'%w_new)

```

```

dZe=1.631374e+01
S=8.156868e+01
S0=8.000000e+01
k1=1.009757
w_new=2603.597525

```

```

[11]: w-w_new

```

```

[11]: 25.402475264779696

```

```

[12]: z=0
      while m.fabs(S-S0)>1:
          print(' Omin=', Omin)
          print(' Omax=', Omax)
          z=z+1
          w_new=round(w_new)
          x_ ( O= Omin,w=w_new)
          x_ ( O= Omax,w=w_new)
          print('\n\n\n\n\n')
          dZe=Ze_max-Ze_min
          print('dZe=%e'%dZe)
          S=dZe/(2*d )
          print('S=%e'%S)
          k1=(S/S0)**0.5
          print('k1=%f'%k1)
          w_new=w_new/k1
          print('w_new=%f'%w_new)

```



```

    print('\n\n\n\n\n')
print('z=%d'%z)
m.fabs(S-S0)
print('w_new=%f'%round(w_new))

```

```

Omin= 0.4
Omax= 0.6
X_= 7.5
O= 0.4
X_/ O= 18.75
Zb_max= 14.423076923076923
Zb= 5.76923076923077
Z_a= 5
Z__b= 5
x__= 6.500
m1=5.650000
m2=6.434615

```

```

G1= 7.996 e-9
G2= 3.267 e-9
G3= 78.540 e-9
G4= 1.634 e-9
m1= 5.65

```

```

G5= 3.736e-9
G6= 0.039 e-9
G7= 1.775 e-9
G8= 3.627 e-9

```

```

Gb4= 116.793 e-9

```

```

Rb4= 8.562 e6

```

```

Gb2= 107.796 e-9

```

```

Rb2= 9.277 e6

```

```

R_ms 17.124 e6

```

```

Ze_max= 0.20 e3
lsr=112.00

```

```

Ra_r=161.53
Ra_im=124.40
I= 0.046501
j<=2..2.5 j= 1.48
U= 9.48

```

X_ = 7.5
O = 0.6
X_ / O = 12.5
Zb_max = 9.615384615384615
Zb = 5.769230769230769
Z_a = 5
Z__b = 5
x__ = 6.500
m1 = 5.600000
m2 = 6.334615

G1 = 7.996 e-9
G2 = 3.267 e-9
G3 = 52.360 e-9
G4 = 1.634 e-9
m1 = 5.6

G5 = 3.613e-9
G6 = 0.058 e-9
G7 = 1.759 e-9
G8 = 3.635 e-9

Gb4 = 90.267 e-9

Rb4 = 11.078 e6

Gb2 = 81.385 e-9

Rb2 = 12.287 e6

R_ms 22.157 e6

Ze_min = 0.19 e3
lsr = 112.00

Ra_r = 161.53
Ra_im = 96.15
I = 0.060165
j <= 2..2.5 j = 1.92
U = 11.31

dZe = 1.590149e+01

```
S=7.950743e+01
k1=0.996917
w_new=2612.053771
```

```
z=1
w_new=2612.000000
```

```
[13]: m.fabs(S-S0)
```

```
[13]: 0.49256902222126087
```

```
[14]: w_new=round(w_new)
#4.1.3.7.
Fsum=w_new**2*(I min**2*Gb4_min/( Omin*1e-3)-I max**2*Gb4_max/( Omax*1e-3))
print('Fsum=%.2f'%Fsum)
print('Fizm=%.2f'%Fizm)
print('Fizm>Fsum*5..10')
print('%.2f>%.2f..%.2f'%(Fizm,Fsum*5,Fsum*10))
```

```
Fsum=0.59
Fizm=15.00
Fizm>Fsum*5..10
15.00>2.96..5.92
```

```
[ ]:
```