Figure 1 shows the critical deflection as a function of diameter for these parameters:

D=2mm

G=82.7 Gpa

E=203.4 Gpa

4mm < Lf < 20mm

C1 = E / ( 2 * ( E – G ) )

C2 = ( 2 * ( pi ^ 2 ) * ( E – G ) ) / ( 2 * G + E )

Aeff = ( a \ D ) * Lf

Y = Lf * C1 * ( 1 - (1 - (C2 / ( Aeff ) ^ 2) ) ^ 0.5 )

Spring supported between flat parallel surfaces (fixed ends):
a=0.5 → Green

One end supported by flat surface perpendicular to spring axis (fixed); other end pivoted (hinged):
a=0.707 → Blue

Both ends pivoted (hinged):
a=1 → Red

One end clamped; other end free:
a=2 → Black

## The script:

```
clear all
close all
clc
Lf=linspace(4,20,1000);
G=82.7*(10^9);
E=203.4*(10^9);
C1=E/(2*(E-G));
C2=(2*(pi^2)*(E-G))/(2*G+E);
D=2;
X=Lf/D;
a=1;
Aeff=(a\D)*Lf;
for i=1:1000;
    y(i)=Lf(i)*C1*(1-(1-(C2/(Aeff(i))^2))^0.5);
    Y(i)=y(i)/Lf(i);
end
plot(X,Y,'color','red')
hold on
a=2;
Aeff=(a\D)*Lf;
for i=1:1000;
    y(i)=Lf(i)*C1*(1-(1-(C2/(Aeff(i))^2))^0.5);
    Y(i)=y(i)/Lf(i);
end
plot(X,Y,'color','black')
hold on
a=0.5;
Aeff=(a\D)*Lf;
for i=1:1000;
    y(i)=Lf(i)*C1*(1-(1-(C2/(Aeff(i))^2))^0.5);
    Y(i)=y(i)/Lf(i);
end
plot(X,Y,'color','green')
hold on
a=0.707;
Aeff=(a\D)*Lf;
for i=1:1000;
    y(i)=Lf(i)*C1*(1-(1-(C2/(Aeff(i))^2))^0.5);
    Y(i)=y(i)/Lf(i);
end
plot(X,Y,'color','blue')
hold on
```

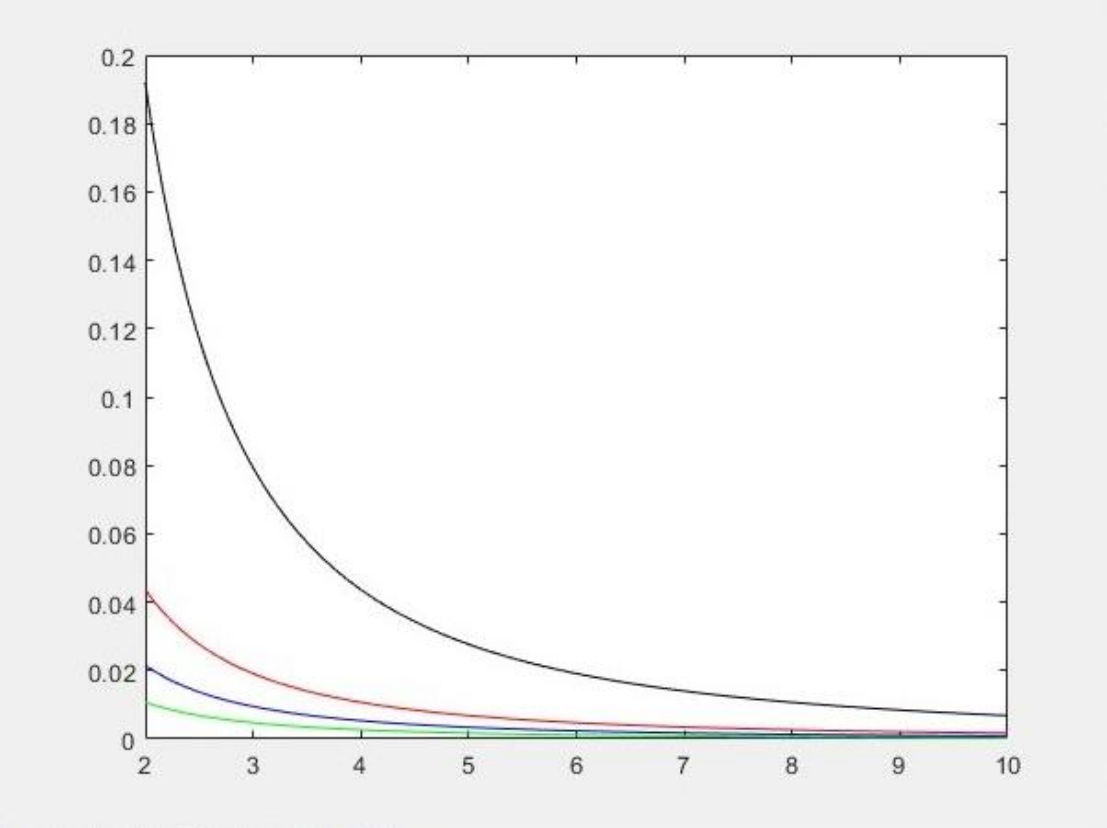


Fig 1. different end conditions - the critical deflection as a function of diameter