MATLAB-programming

Bisection Method

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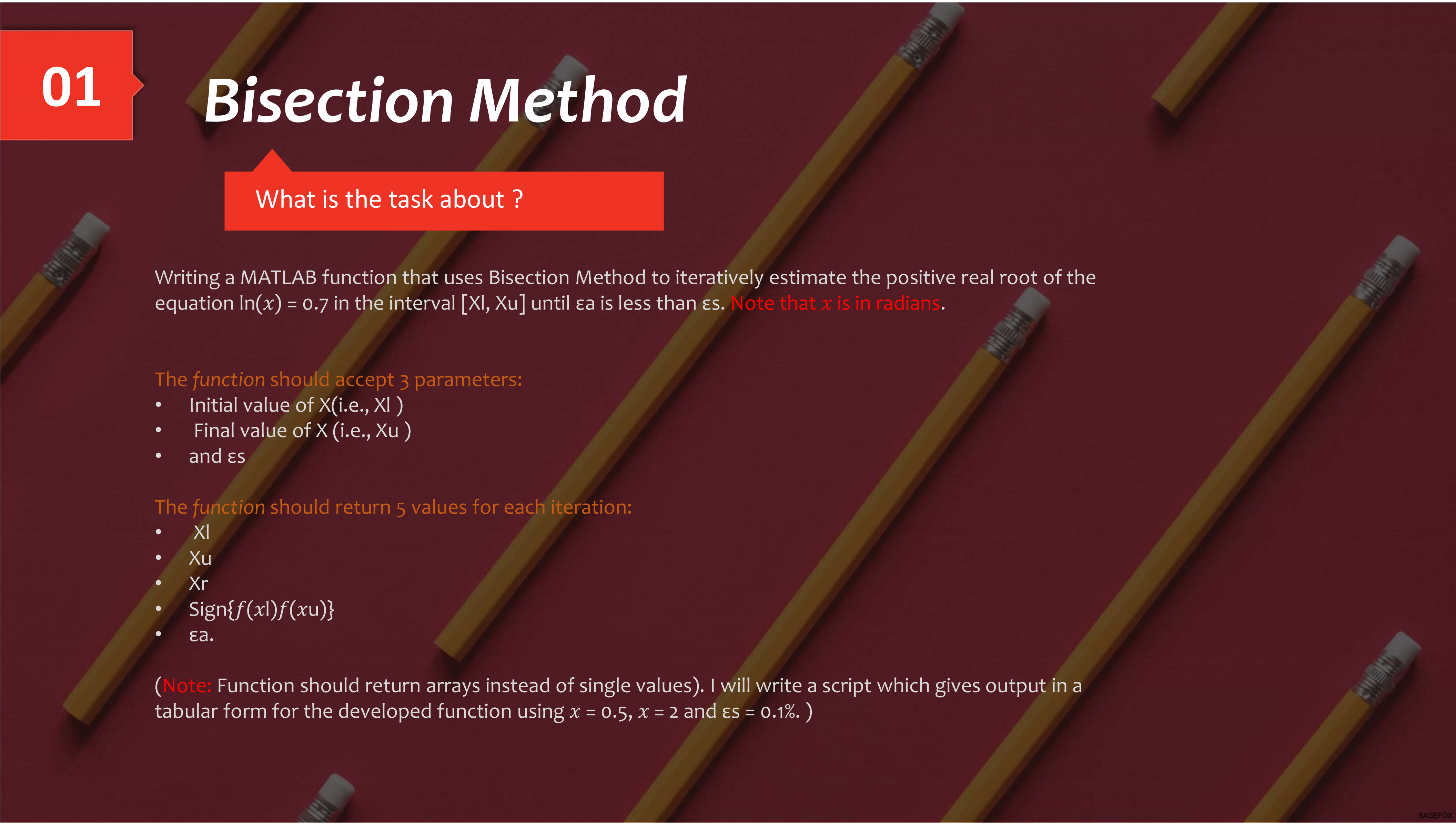


01

Bisection Method

What is the task about ?

Writing a MATLAB function that uses Bisection Method to iteratively estimate the positive real root of the equation ln(x) = 0.7 in the interval [Xl, Xu] until εa is less than εs. Note that x is in radians.

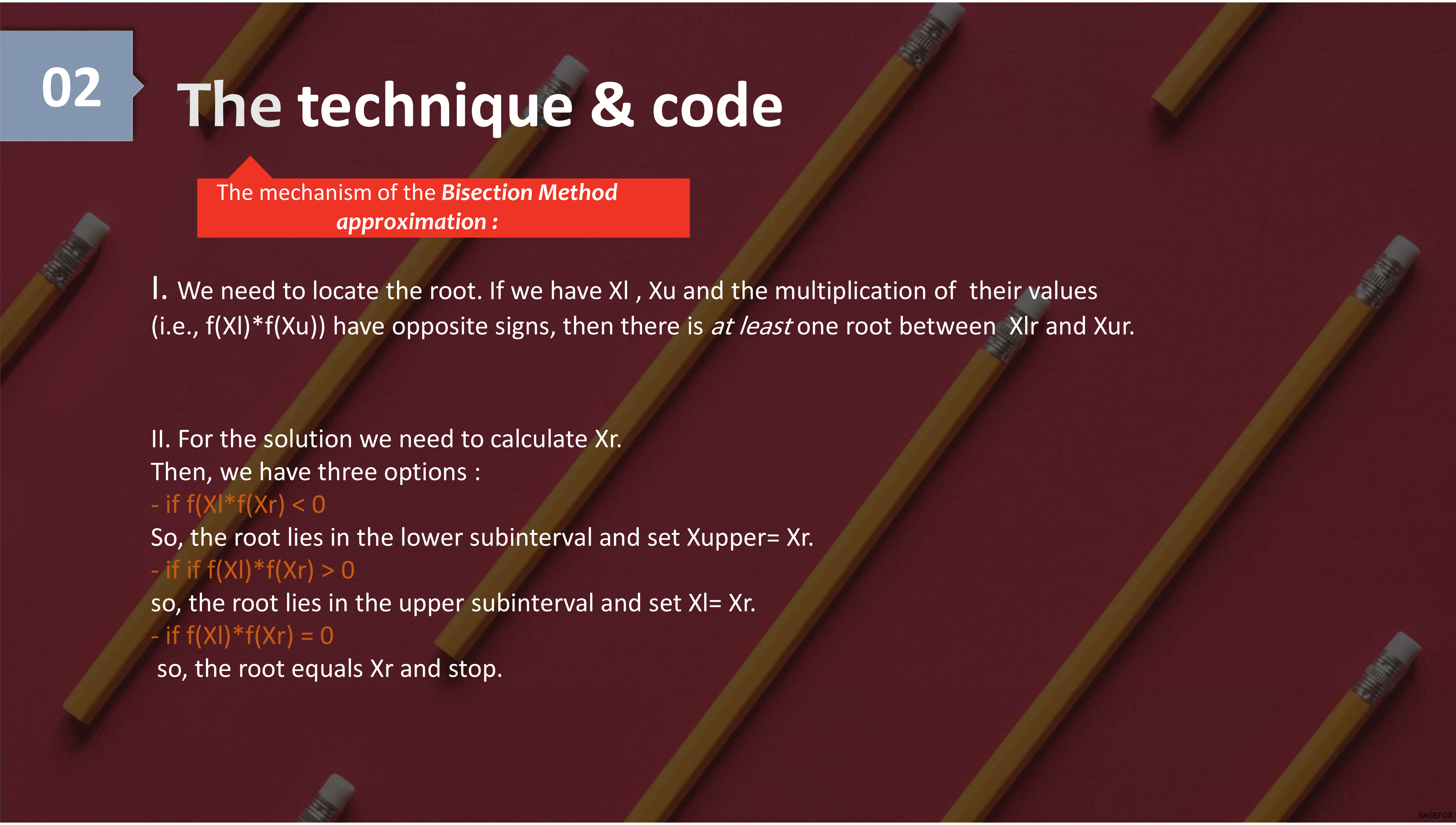
The *function* should accept 3 parameters:

- Initial value of X(i.e., Xl)
- Final value of X (i.e., Xu)
- and εs

The *function* should return 5 values for each iteration:

- Xl
- Xu
- Xr
- Sign{$f(x\mathrm{l})f(x\mathrm{u})$}
- εa.

(Note: Function should return arrays instead of single values). I will write a script which gives output in a tabular form for the developed function using x = 0.5, x = 2 and εs = 0.1%.)



02

The technique & code

The mechanism of the ***Bisection Method approximation :***

I. We need to locate the root. If we have Xl , Xu and the multiplication of their values (i.e., f(Xl)*f(Xu)) have opposite signs, then there is *at least* one root between Xlr and Xur.

II. For the solution we need to calculate Xr.
Then, we have three options :
- if f(Xl*f(Xr) < 0
So, the root lies in the lower subinterval and set Xupper= Xr.
- if if f(Xl)*f(Xr) > 0
so, the root lies in the upper subinterval and set Xl= Xr.
- if f(Xl)*f(Xr) = 0
so, the root equals Xr and stop.

02 The code

Pseudocode of a MATLAB function that calculates the approximate the root of ln(x)=0.7:

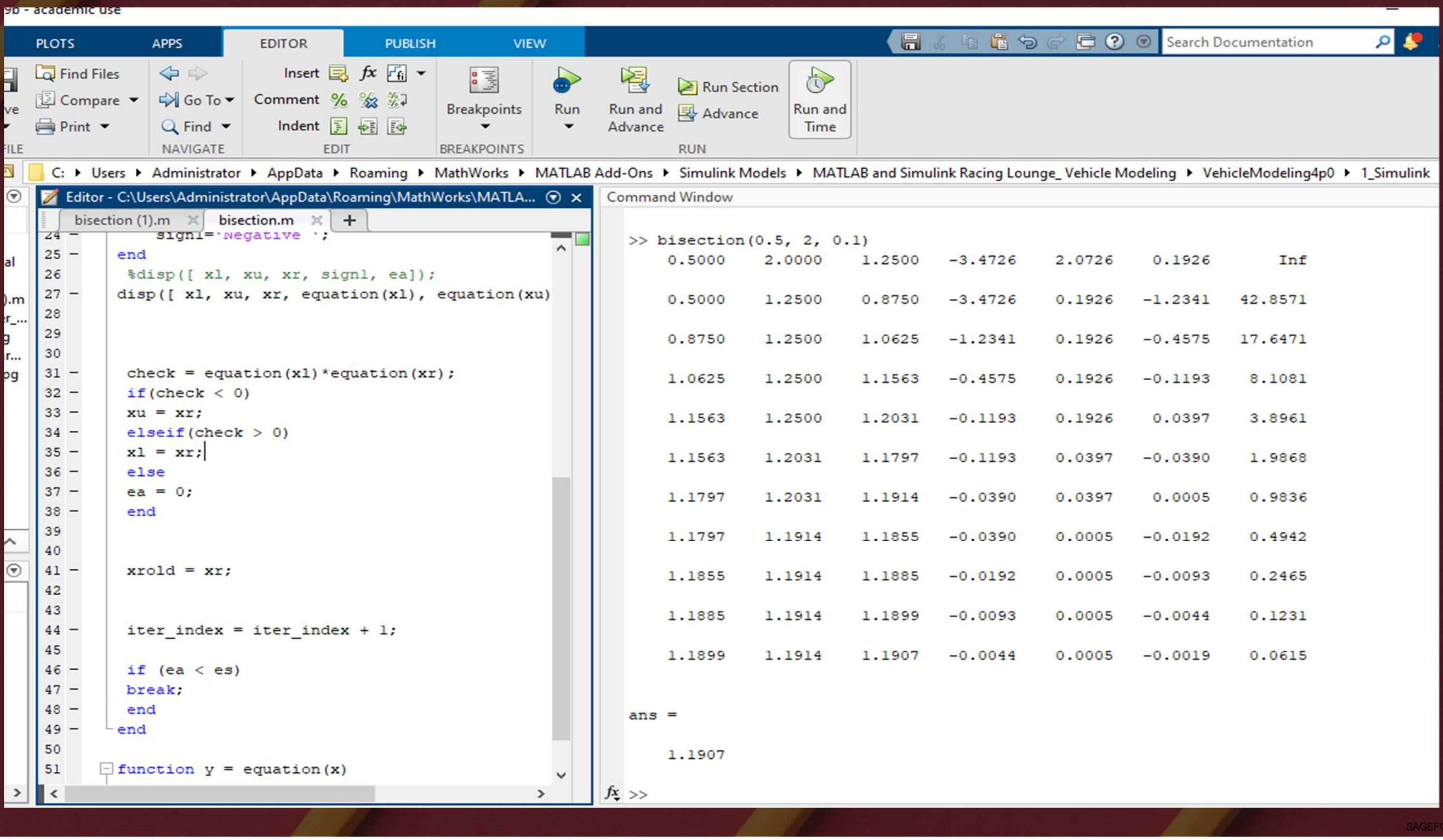
```
unction [xl,xu,xr,sign1,ea]=bisection(xl, xu, es)
iter_index = 0;

xrold = Inf;

while (1)

 xr = (xl + xu)/2;

 if(xr ~= 0)
 ea = abs( (xr - xrold) / xr)* 100;
 end


check = equation(xl)*equation(xr);
if sign(check)
   sign1='postive ';
 else
   sign1='Negative ';
end
```

```
disp([ xl, xu, xr, equation(xl), equation(xu), equation(xr), ea]);

 check = equation(xl)*equation(xr);
 if(check < 0)
 xu = xr;
 elseif(check > 0)
 xl = xr;
 else
 ea = 0;
 end


 xrold = xr;

 iter_index = iter_index + 1;

 if (ea < es)
 break;
 end
end

function y = equation(x)

y = log(x^4)-0.7;
```

04 The output samples

Showing the snapshot of the output of the script

The result conforms the solution and it shows Xlower, Xupper, Xr, the sign of f(Xlower)*f(Xupper) and epsilonA for each step.


ab - academic use
PLOTS
APPS
EDITOR
PUBLISH
VIEW
Search Documentation
Find Files
Compare
Print
Go To
Find
NAVIGATE
Insert
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BREAKPOINTS
Run
Run and Advance
Run Section
Advance
Run and Time
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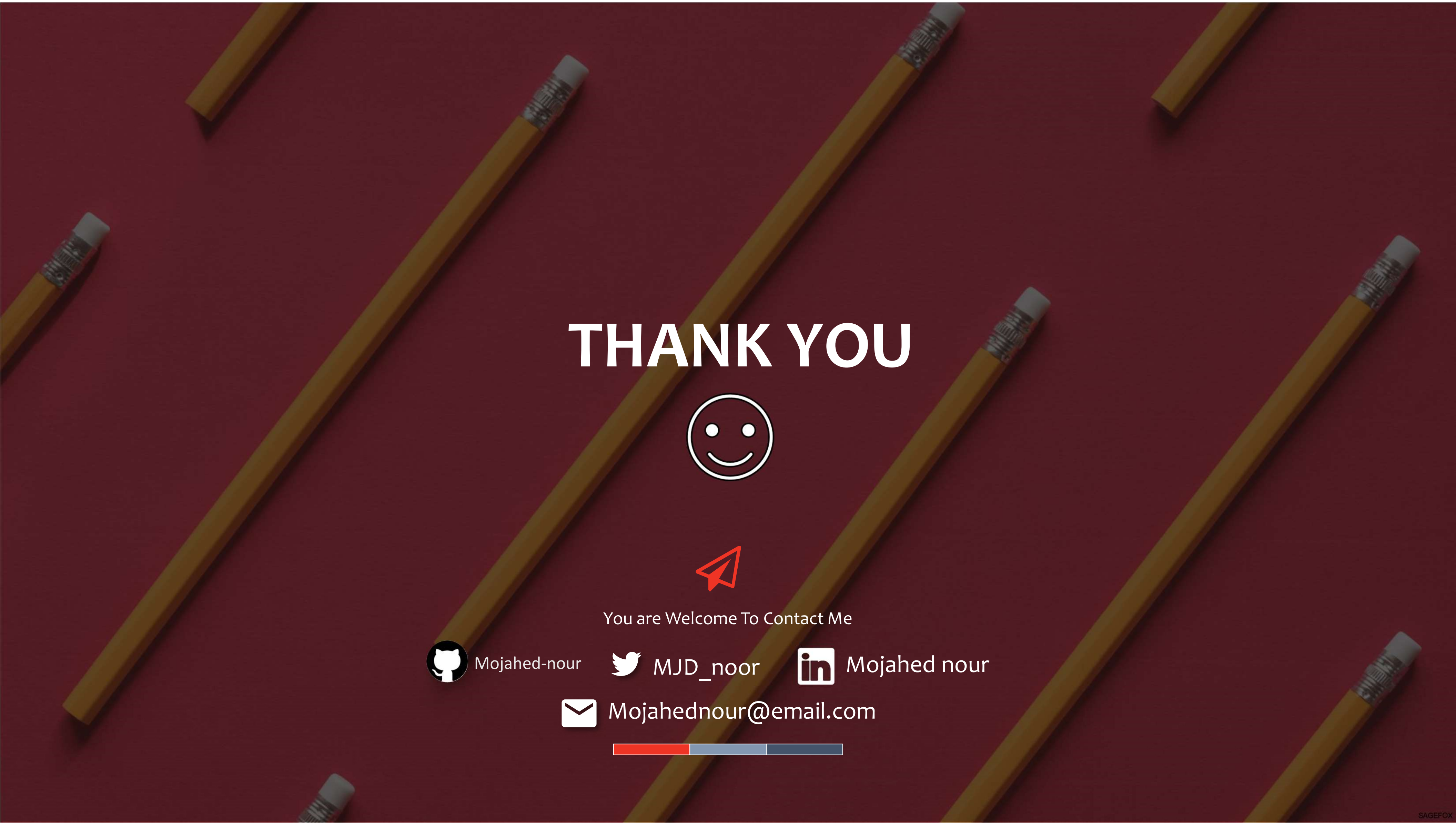
C: ▸ Users ▸ Administrator ▸ AppData ▸ Roaming ▸ MathWorks ▸ MATLAB Add-Ons ▸ Simulink Models ▸ MATLAB and Simulink Racing Lounge_ Vehicle Modeling ▸ VehicleModeling4p0 ▸ 1_Simulink
Editor - C:\Users\Administrator\AppData\Roaming\MathWorks\MATLA...
bisection (1).m
bisection.m
Command Window

```
        signl='Negative ';
    end
     %disp([ xl, xu, xr, signl, ea]);
    disp([ xl, xu, xr, equation(xl), equation(xu)



     check = equation(xl)*equation(xr);
     if(check < 0)
     xu = xr;
     elseif(check > 0)
     xl = xr;
     else
     ea = 0;
     end


     xrold = xr;


     iter_index = iter_index + 1;

     if (ea < es)
     break;
     end
    end

   function y = equation(x)
```

```
>> bisection(0.5, 2, 0.1)
    0.5000    2.0000    1.2500   -3.4726    2.0726    0.1926       Inf

    0.5000    1.2500    0.8750   -3.4726    0.1926   -1.2341   42.8571

    0.8750    1.2500    1.0625   -1.2341    0.1926   -0.4575   17.6471

    1.0625    1.2500    1.1563   -0.4575    0.1926   -0.1193    8.1081

    1.1563    1.2500    1.2031   -0.1193    0.1926    0.0397    3.8961

    1.1563    1.2031    1.1797   -0.1193    0.0397   -0.0390    1.9868

    1.1797    1.2031    1.1914   -0.0390    0.0397    0.0005    0.9836

    1.1797    1.1914    1.1855   -0.0390    0.0005   -0.0192    0.4942

    1.1855    1.1914    1.1885   -0.0192    0.0005   -0.0093    0.2465

    1.1885    1.1914    1.1899   -0.0093    0.0005   -0.0044    0.1231

    1.1899    1.1914    1.1907   -0.0044    0.0005   -0.0019    0.0615


ans =

    1.1907

>>
```



THANK YOU

You are Welcome To Contact Me

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