MATLAB-programming

Maclaurin series approximation

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01

Maclaurin series approximation

What is the task about ?

Writing a MATLAB function that calculates the approximate value of arctan(x) using the Maclaurin series approximation:

arctan(x) = x −x^3/3 +x^ 5/5− x^7/7+ ⋯

The *function* should accept 3 parameters:

- value of x
- number of significant figures accuracy i.e. n
- the maximum number of iterations.

In the function, use ε = (0.5 × 10)% in order to continue until the ε falls below this criteria.

The *function* should return 3 values:

- the approximate value of arctan(x) at the end of the program
- final ε
- the number of iterations it took.

02 The technique & code

The mechanism of the ***Maclaurin series approximation :***

I. It can be SOLVED by Taylor with xi=0 which helps us to approximate the true value.
As we do more iterations the approximation will get more better than before.

II. We should have initial value of X and fix the maximum number of iterations and the number of required significant figures.

III. In the output ,showing the program running from the command prompt for x = 0.4 and 0.8.

02 The code

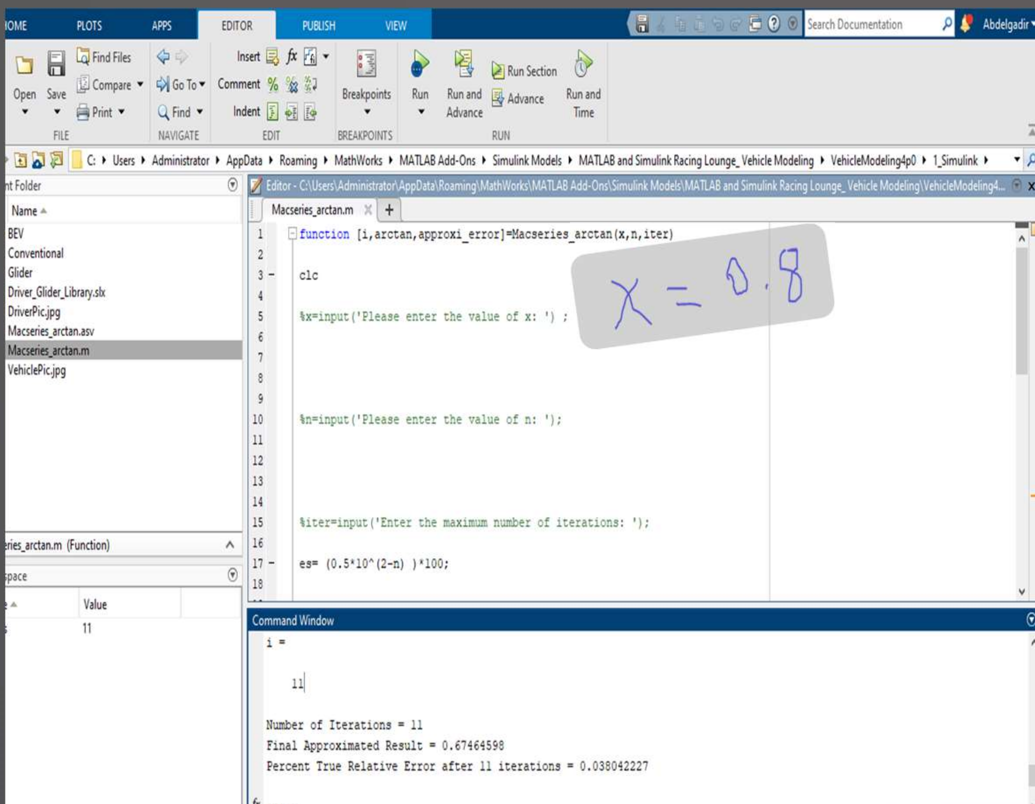
Pseudocode of a MATLAB function that calculates the approximate value of arctan(x)：

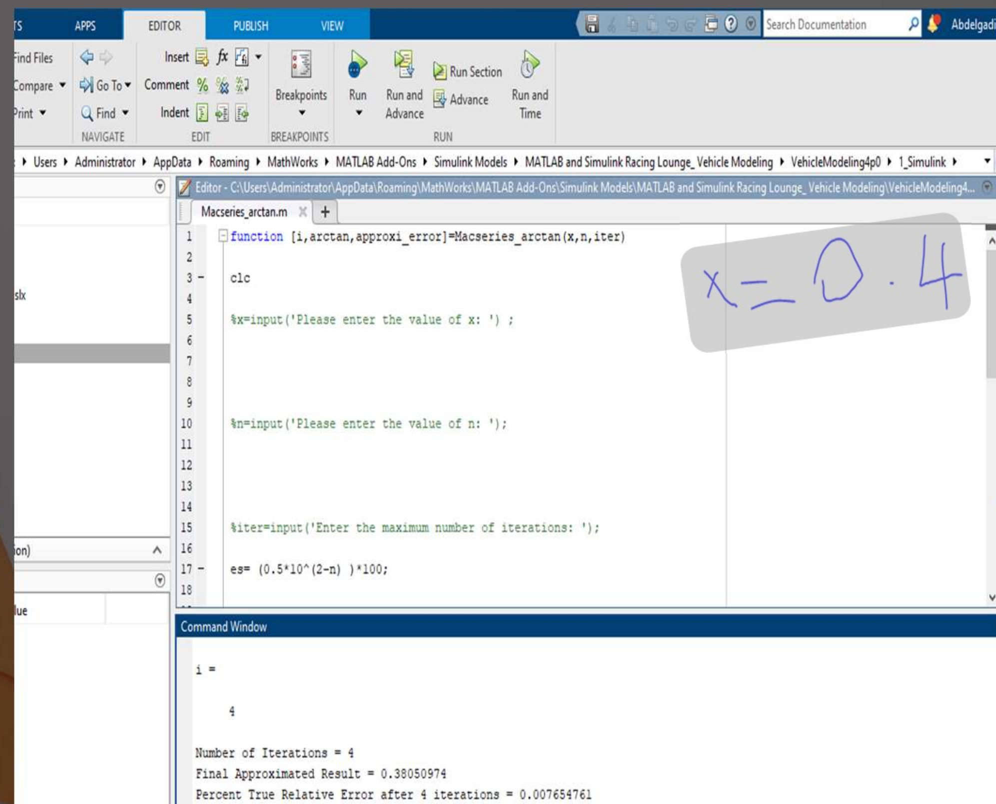
```
function [i,arctan,approxi_error]=Macseries_arctan(x,n,iter)

clc

%x=input('Please enter the value of x: ') ;

%n=input('Please enter the value of n: ');

%iter=input('Enter the maximum number of iterations: ‘);
es= (0.5*10^(2-n) )*100;

arctan=x;
for i=1:iter

arctan_old=arctan;

arctan=arctan+(-1)^i * x^(i*2+1)/(i*2+1);

approxi_error=abs((arctan-arctan_old)*100/arctan);

if (approxi_error<=es)
break ;

end

i = i +1 ;

end

fprintf('Number of Iterations = %d\n',i)
fprintf('Final Approximated Result = %.8g\n',arctan);
fprintf('Percent True Relative Error after %d
iterations = %.8g\n',i,approxi_error);
end
```

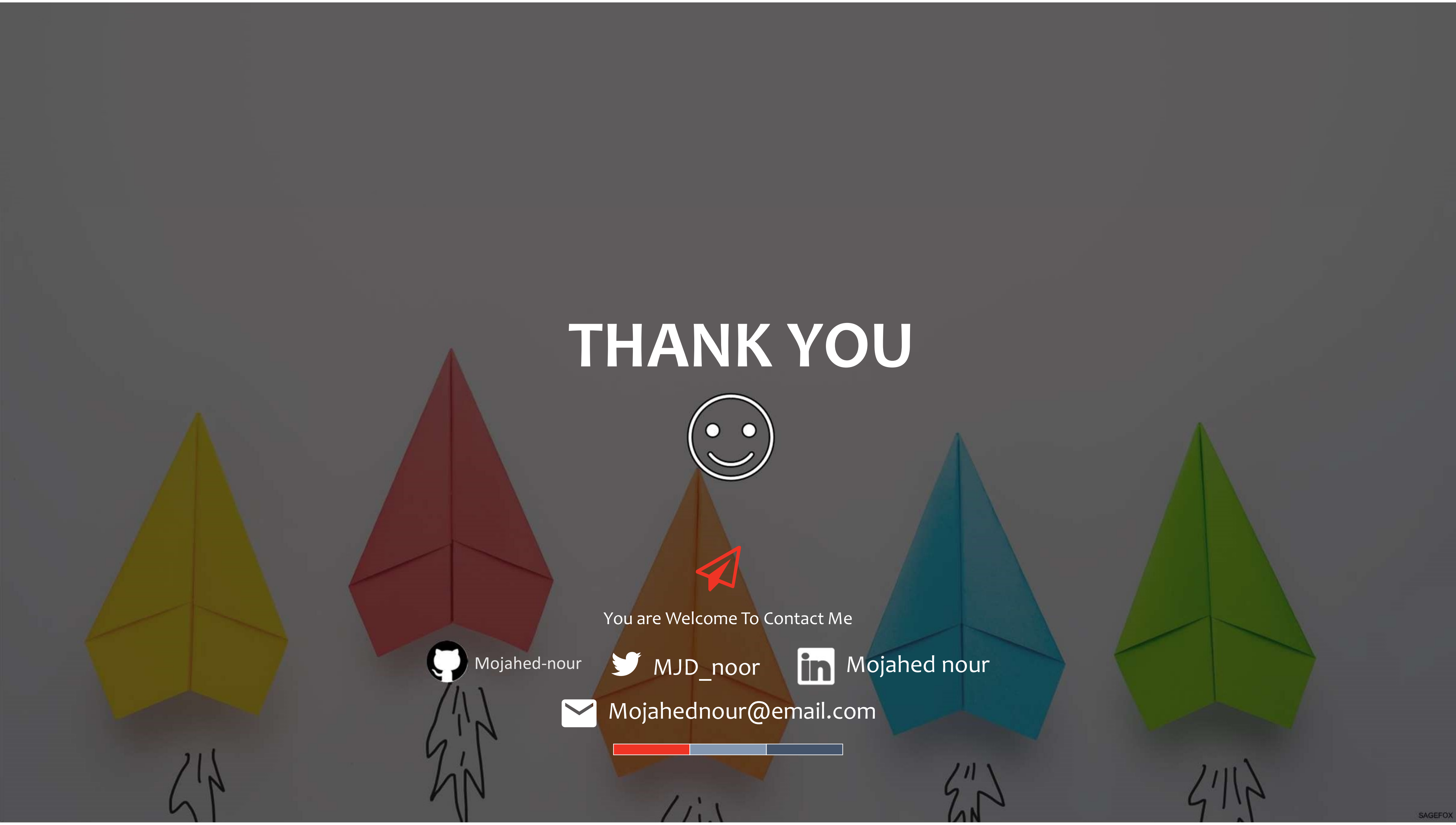
04 The output samples

Showing the program running from the command prompt for x = 0.4 and 0.8.

As we use number of iteration equal 6. the significant figures are equal 4. The result conforms the true value for the epsilonS and epsilonA.







THANK YOU

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