Objectives :

- Learn about Object Oriented Programming
- Learn About Simulink

Object Oriented Programming

Introduction:

Object-oriented programming is a design approach that enables you to programmatically define structures called *objects* that combine data (properties) together with functions that operate on that data (methods). In MATLAB, you can create objects that model the behavior of devices and systems in the real world. Those objects can then be used as building blocks in applications used to simulate and analyze complex systems.

The Components of a MATLAB Class

A MATLAB class contains a blueprint or set of instructions used to build a specific type of object. Class definitions start with the classdef keyword and have three major components:

- *Properties* blocks define the properties that store data for each of the objects of the class
- *Methods* blocks contain a set of functions that define the operations that can be performed on each object of the class

To create class in matlab we can go to **New** and select class, After finishing our class declaration we save the file same as the class name

Example :

robot.m

```
classdef robot

    properties
        id
    end

    methods
        function obj = robot(id)

            obj.id = id;
        end

        function outputArg = talk(obj)

            disp("Hello my id is")
            disp(obj.id);
            outputArg = obj.id;
        end
    end
end
```

We can notice that we create properties and methods separately.

Also, we can notice that the first method often has the same name as the class name. We call this the **constructor**. It runs automatically when we create an object from our class.

We use this class as follows

```
robot1 = robot("1548")
robot1.talk();
```

The first line is to create an object from our class. The argument that we will pass will go to the constructor method.

The second line is where we use the class method `talk`

OOP concepts

- **Encapsulation** means to enclose data by containing it within an object.
- **Abstraction** is Hiding the complexity of code inside simplified classes. When solving problems, we will just use the simple interface and methods that the class provides without needing to know their internal workings.
- **Inheritance** is the ability of a class to inherit from other classes and acquire their methods, attributes, and even their constructors.
- **Polymorphism** allows objects of different classes to be treated as objects of a common type, even though they may behave differently for the same method call

Remarque

Matlab don't support inheritance yet

Working with simulink

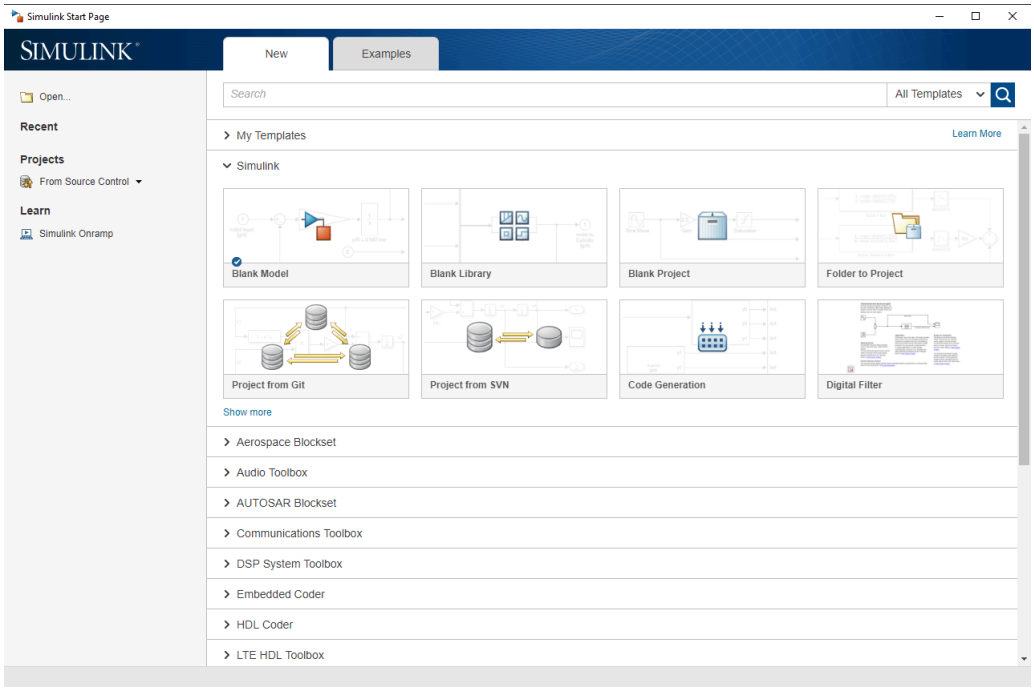
Introduction

Simulink is a powerful tool within the MATLAB environment that allows us to design, simulate, and analyze dynamic systems using a graphical block diagram approach. Instead of writing lines of code, we build models by connecting blocks that represent different components of your system.

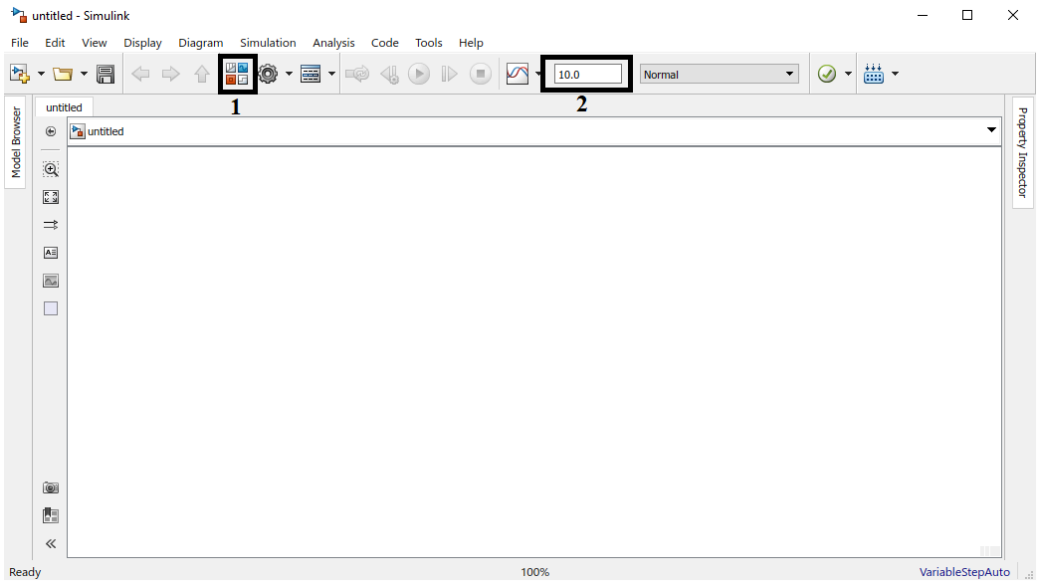
We open Simulink by clicking clicking over it in the tools bar

Simple manipulation using Simulink

After we clicking on the Simulink button we will get this

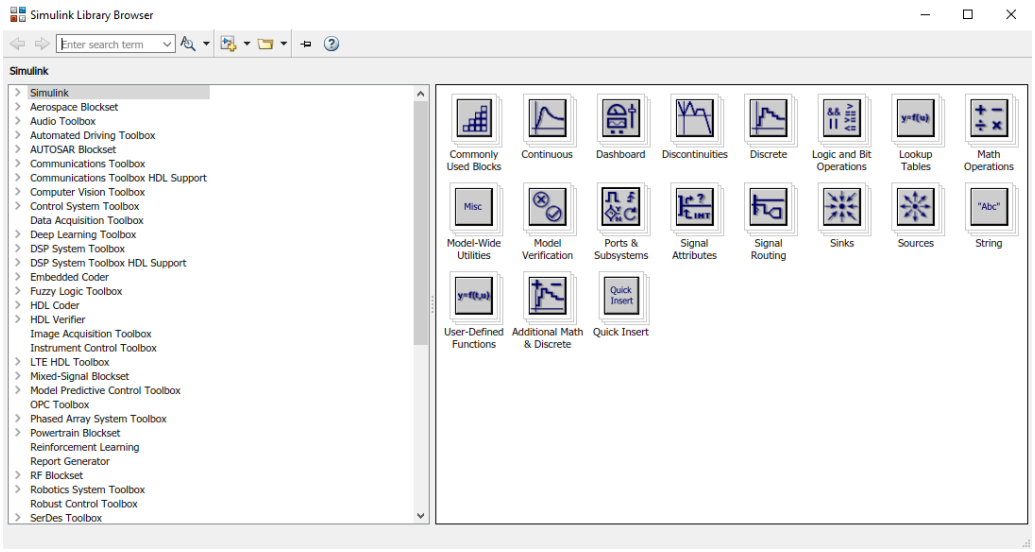


We click in blank model to get empty model to work on, this will open the matlab working envirenment



- 1 Library Browser we use it to get Library and load function and blocs that we need for for our simulation
- 2 Simulation time we use it to set the simulation time

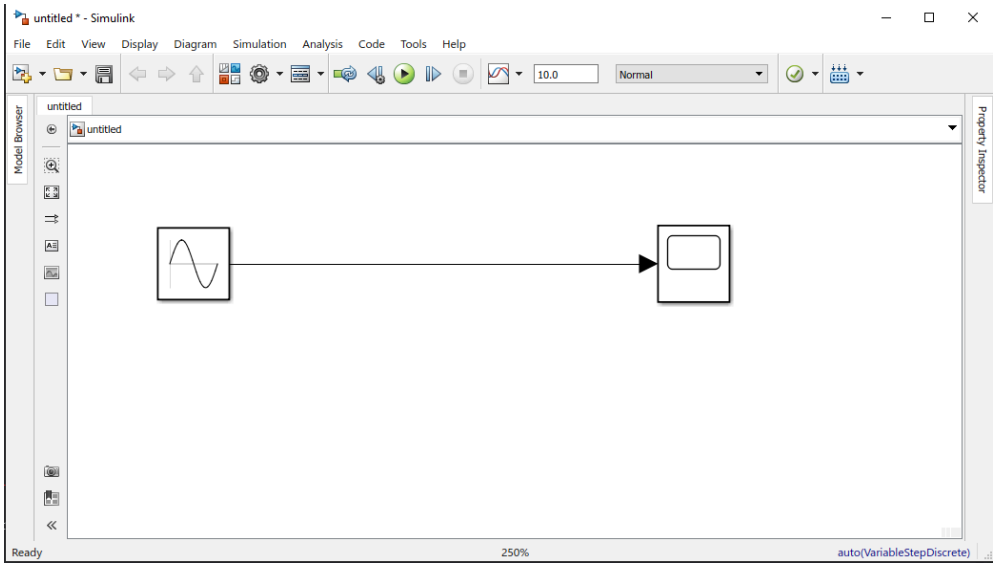
After clicking the Library Browser we will get this window



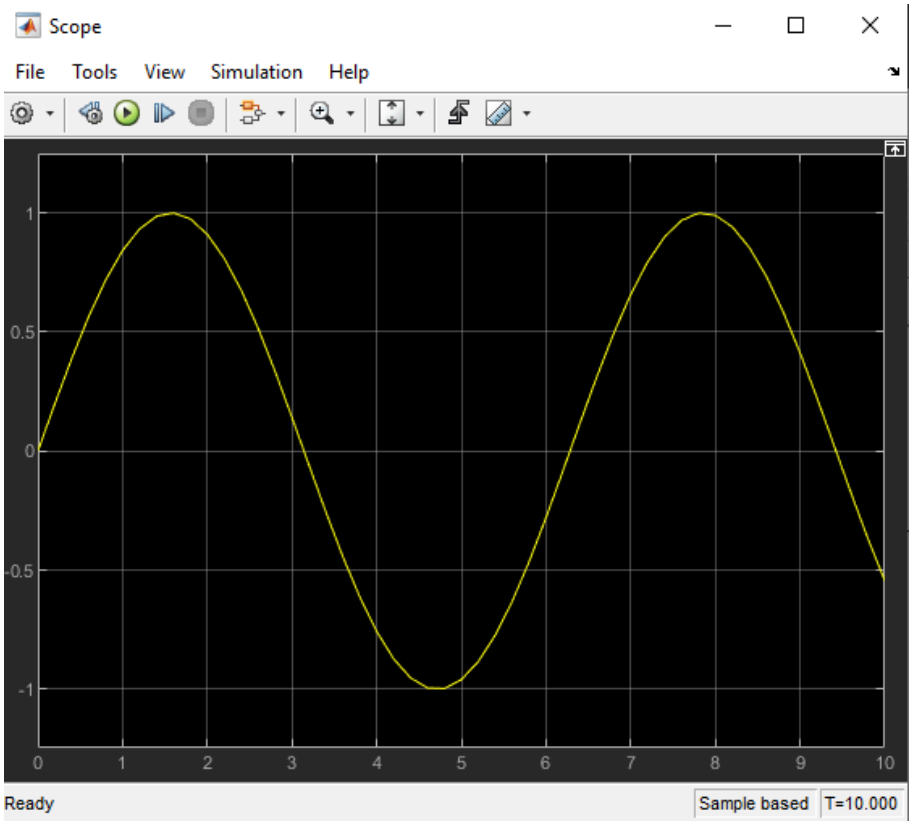
we use it to select blocs that we need and drag them to the working envirenment , after doing this we just rely between then and click the run button

Example:

simulating sinus function



After clicking on run and clickin in the scop bloc we get the following result



Tasks:

Task 1

Solve $ax^2 + bx + c = 0$ using Object-oriented programming approch

Hints:

- Class should have 3 properities a b and c
- Class Contructor should take 3 argument and set the properities a b and c
- The class should have solver method that solve the equation and return the roots and if solution don't exist it return text say solution don't exist

Task 2

Use simulink to represent the function

$$5 * cos(x) - 2 * sin(x)$$