

# BRIEF INTRODUCTION TO SIMULINK

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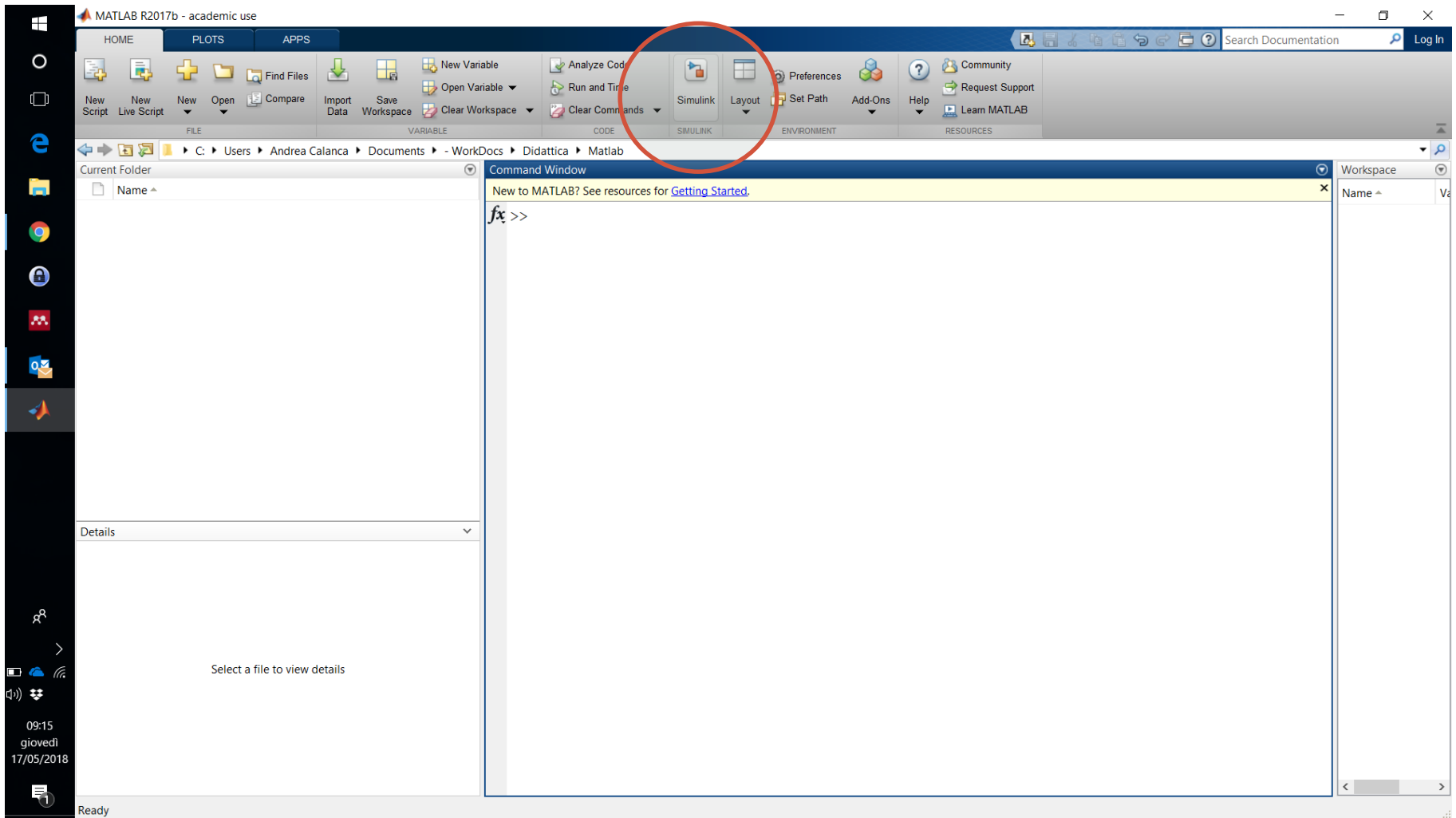


# Introduction to Simulink

- Simulink is a commercial tool for modeling, simulating and analyzing dynamic systems.
- Its primary interface is a graphical block diagramming tool and a customizable set of block libraries.
- It offers tight integration with the rest of the MATLAB environment and can either drive MATLAB or be scripted from it.
- Simulink is widely used in control theory and digital signal processing for simulation and design.

# Introduction to Simulink

## Running Simulink

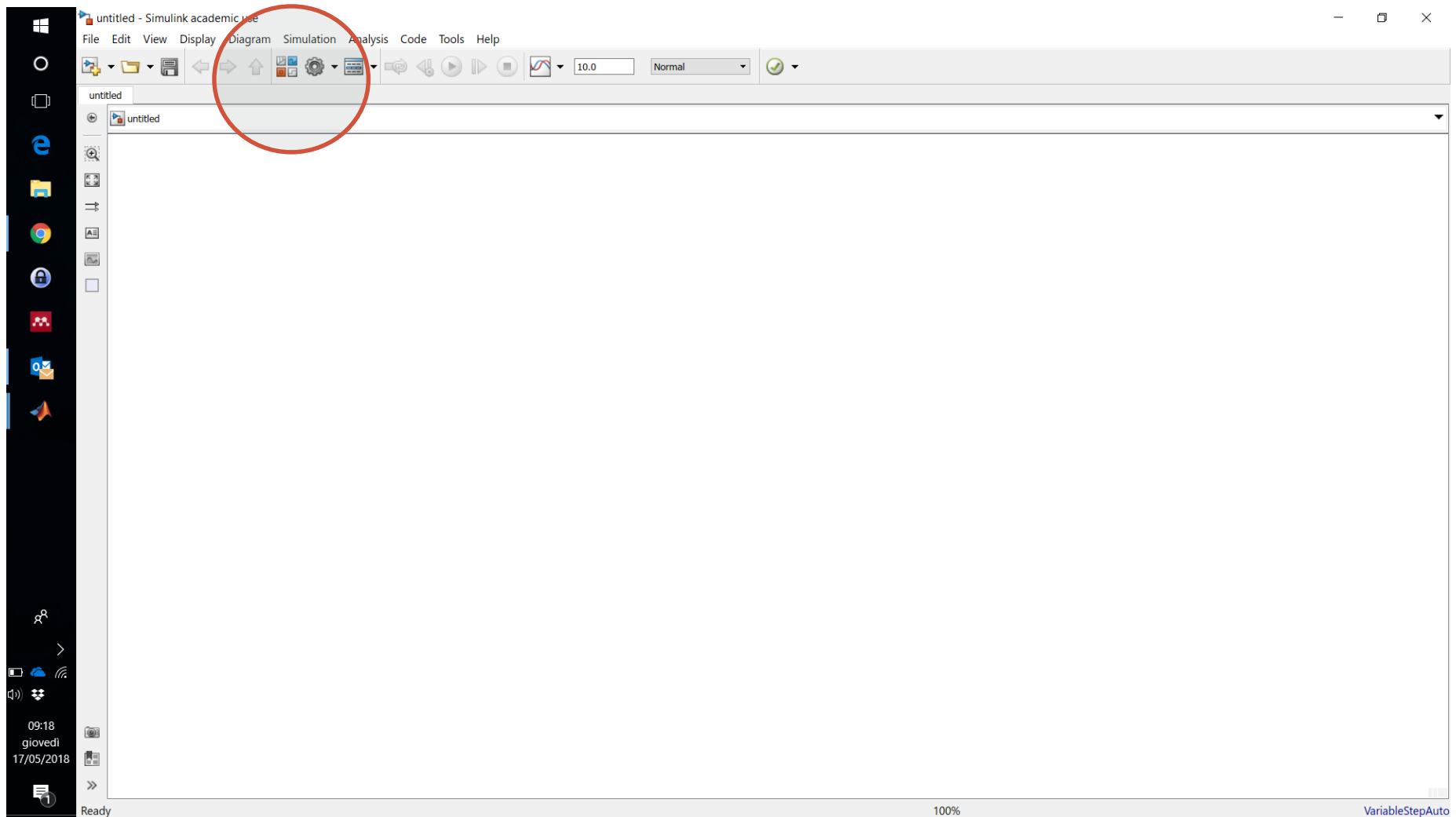


# Introduction to Simulink

The screenshot displays the Simulink Start Page within the MATLAB R2017b environment. The interface is organized into several key sections:

- Navigation Pane (Left):** Contains 'Open...', 'Recent', and 'Projects' sections. The 'Projects' section lists 'Source Control...' and 'Archive...'.
- Header:** Features the 'SIMULINK' logo and tabs for 'New' and 'Examples'.
- Search and Templates:** A search bar is located at the top right. Below it, a grid of templates is shown, including 'Blank Library', 'Blank Project', 'Folder to Project', 'Blank Model', 'Source Control', 'Code Generation', 'Digital Filter', and 'Feedback Controller'.
- Blank Model Detail:** The 'Blank Model' template is expanded, showing a block diagram with an input 'mdot Input (g/s)', a summing junction, a gain block, and an output 'pI0 = 0.543 bar'. A 'Create Model' button is visible next to it.
- Footer:** The bottom status bar shows 'Ready'.

# Introduction to Simulink



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## Library Browser

The screenshot shows the Simulink Library Browser window open in a MATLAB environment. The main window is titled "untitled - Simulink academic use" and has a menu bar with "File", "Edit", "View", "Display", "Diagram", "Simulation", "Analysis", "Code", "Tools", and "Help". The toolbar includes icons for file operations, navigation, and simulation. The main workspace is empty, showing a tab for "untitled".

The Simulink Library Browser window is titled "Simulink Library Browser" and has a search bar with the text "Enter search term". The left pane shows a tree view of the Simulink library structure:

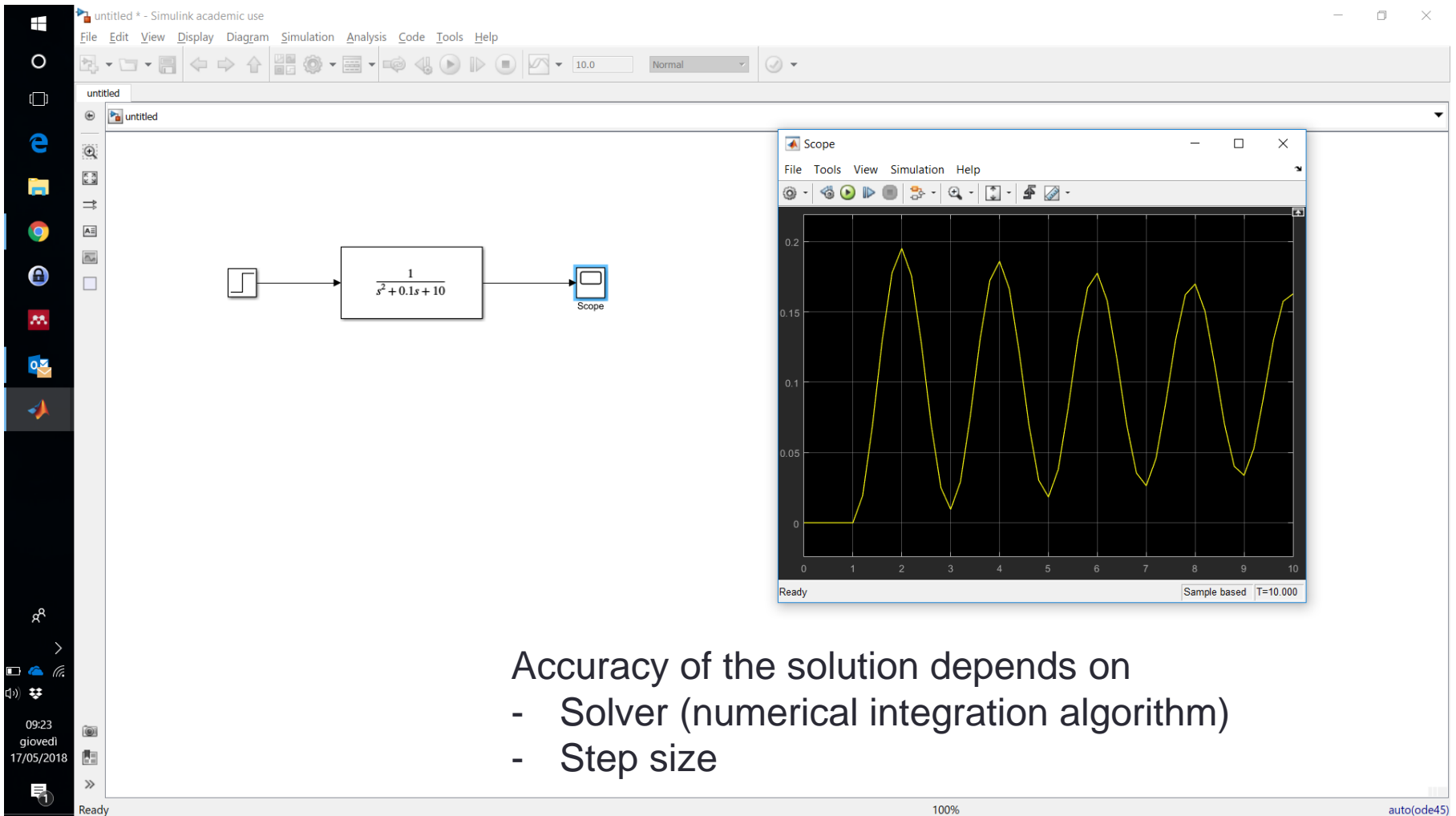
- Simulink
  - Commonly Used Blocks
  - Continuous
  - Dashboard
  - Discontinuities
  - Discrete
  - Logic and Bit Operations
  - Lookup Tables
  - Math Operations
  - Model Verification
  - Model-Wide Utilities
  - Ports & Subsystems
  - Signal Attributes
  - Signal Routing
  - Sinks
  - Sources
  - User-Defined Functions
    - Additional Math & Discrete
  - Control System Toolbox
  - Data Acquisition Toolbox
  - DSP System Toolbox
  - DSP System Toolbox HDL Support
  - HDL Coder
  - Instrument Control Toolbox
  - Model Predictive Control Toolbox
  - Neural Network Toolbox
  - Robotics System Toolbox
  - Robust Control Toolbox
  - Simulink 3D Animation
  - Simulink Coder
  - Simulink Control Design
  - Simulink Extras
  - Stateflow

The right pane displays a grid of icons representing various Simulink blocks and toolboxes:

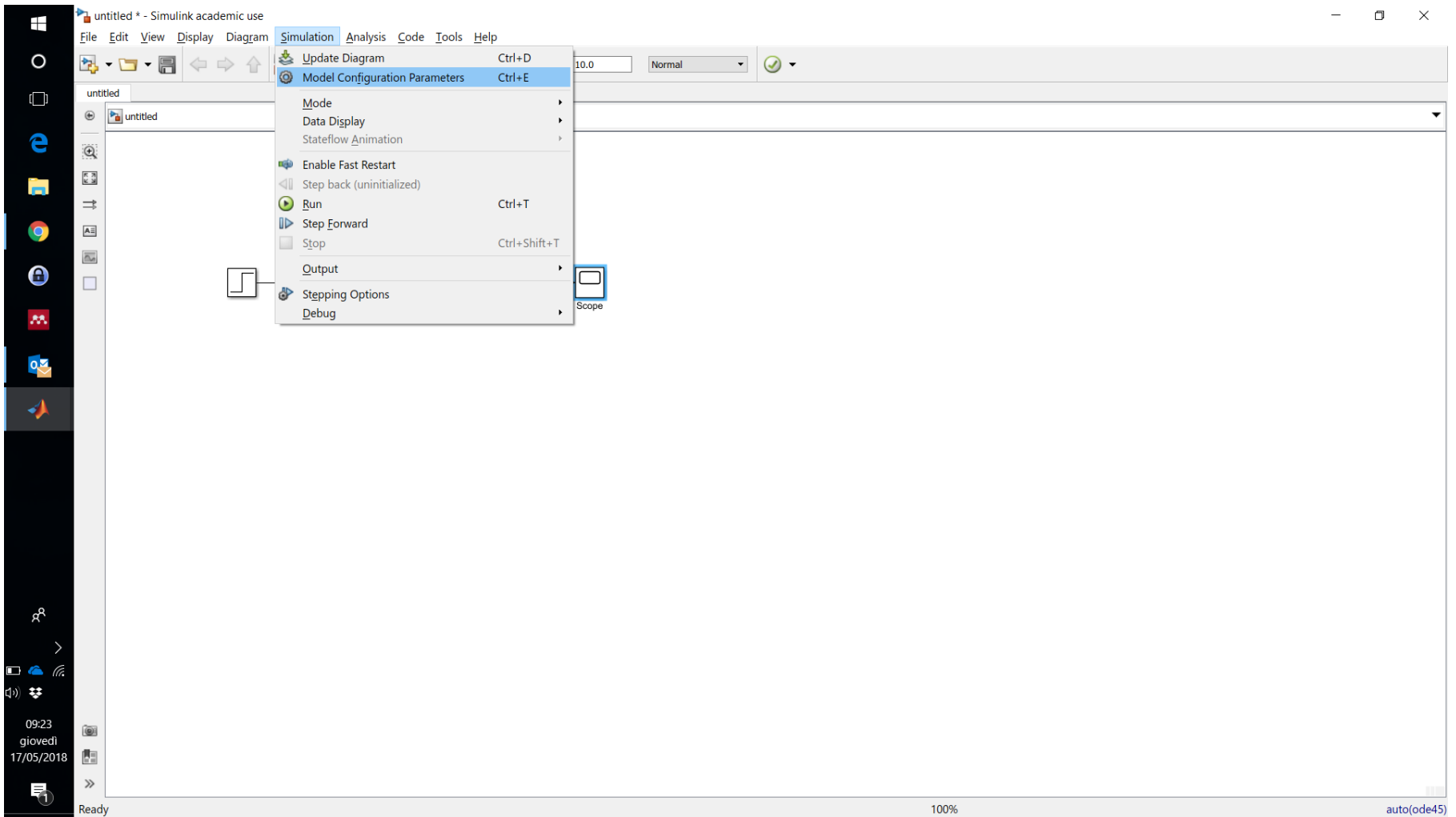
- Commonly Used Blocks
- Continuous
- Dashboard
- Discontinuities
- Discrete
- Logic and Bit Operations
- Lookup Tables
- Math Operations
- Misc
- Model-Wide Utilities
- Model Verification
- Ports & Subsystems
- Signal Attributes
- Signal Routing
- Sinks
- Sources
- User-Defined Functions
- Additional Math & Discrete

The status bar at the bottom of the MATLAB window shows "Ready", "100%", and "VariableStepAuto". The system tray on the left shows the time "09:19", the date "giovedì 17/05/2018", and a notification icon.

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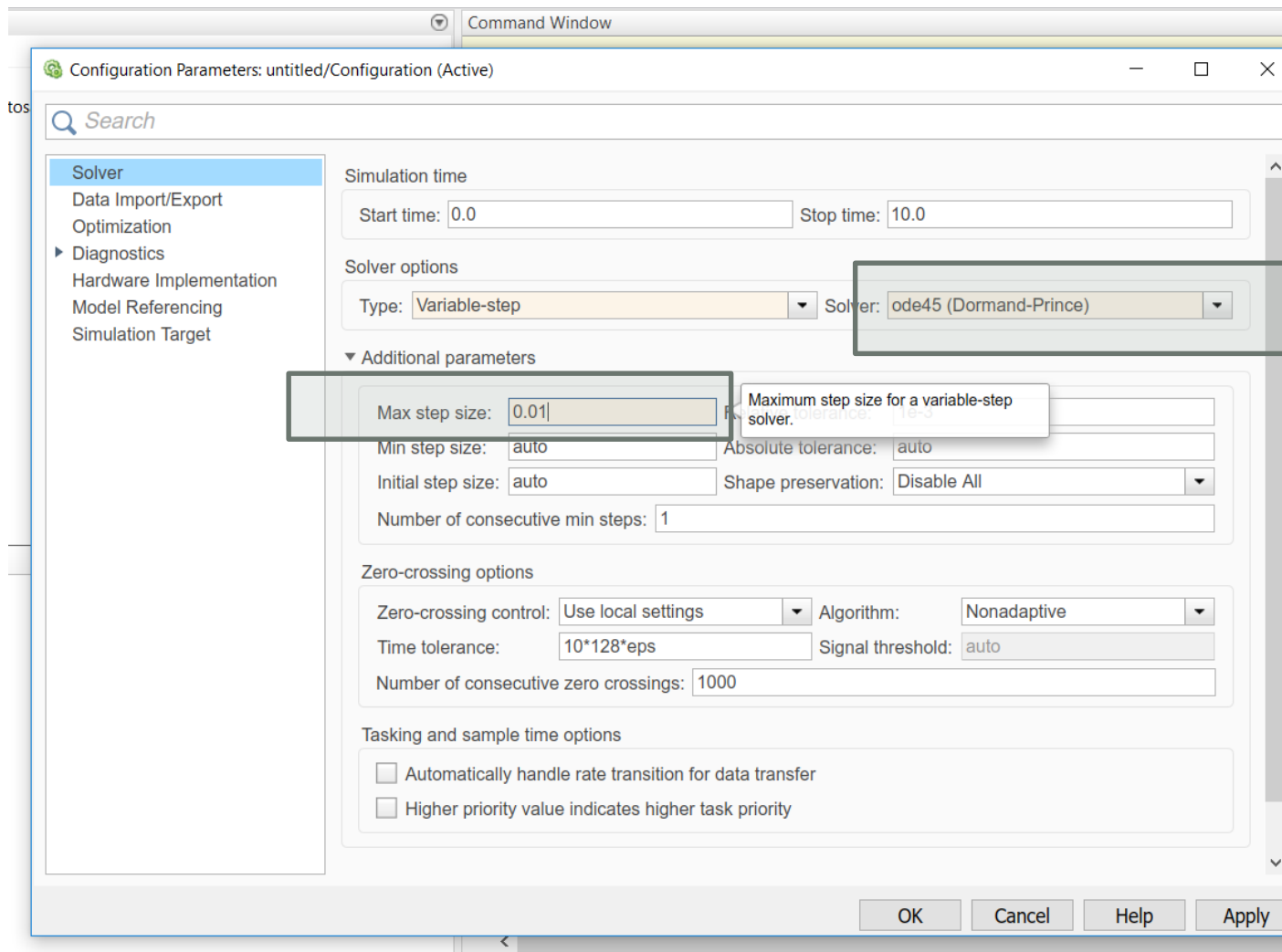


# Introduction to Simulink





# Introduction to Simulink



# Introduction to Simulink

The screenshot displays the MATLAB R2017b Simulink environment. The main workspace shows a Simulink model with a block labeled  $\frac{1}{s^2 + 0.1s + 10}$ . A Scope window is open, showing a plot of a sine wave with an amplitude of approximately 0.18 and a period of about 3.5 units. The plot is titled "Scope" and has a time axis from 0 to 10. A configuration dialog box is open over the Scope window, showing the "Solver" tab. The dialog box contains the following text:

Issue a diagnostic if consecutive zero crossings cause more than "N" small time steps.

The dialog box also shows the "Solver" section with the following options:

- Solver: Data Import/Export, Optimization, Diagnostics, Hardware Implementation, Model Referencing, Simulation Target
- Simulation time: Start time: untitled
- Solver options: Type: Variable
- Additional parameters: Max step, Min step, Initial step, Number of
- Zero-crossing: Zero-crossing, Zero-crossing, Time tolerance, Number of
- Tasking and scheduling:  Autom,  High

The dialog box has "OK", "Cancel", "Help", and "Apply" buttons at the bottom. The Scope window shows a "Ready" status and "Sample based T=10.000".

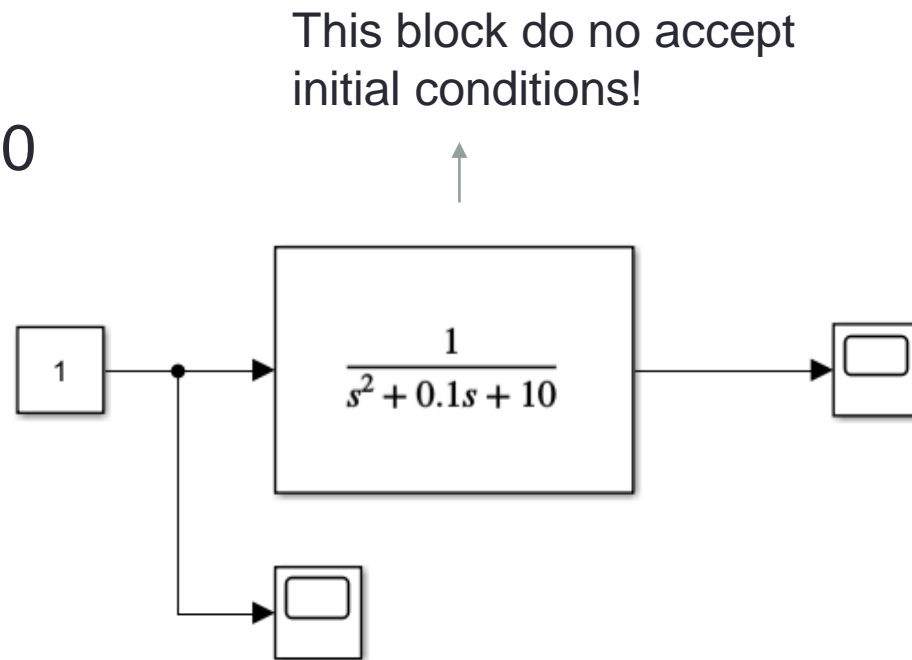
Improved accuracy!

# Introduction to Simulink

## Exercise 1

Simulate a mass-spring-damper system using the block transfer function

$$m = 1, d = 0.1, k = 10$$



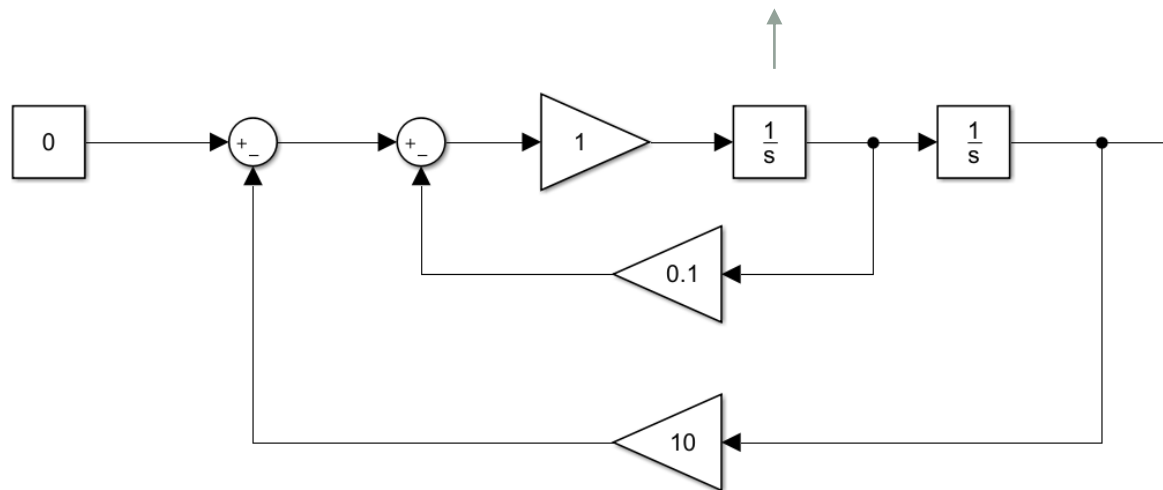
# Introduction to Simulink

## Exercise 2

Simulate a mass-spring-damper system using the block integrator

$$m = 1, d = 0.1, k = 10$$

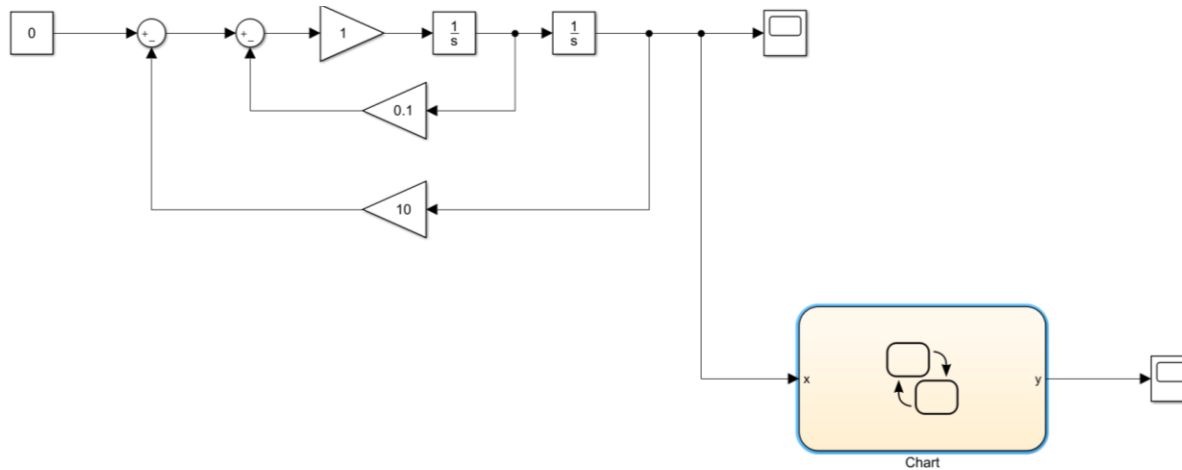
This block accepts  
initial conditions!



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## Exercise 3

Use stateflow to implement a FSM which accept the mass position as input



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