

DSP Lab 06: Implementing digital systems in Simulink

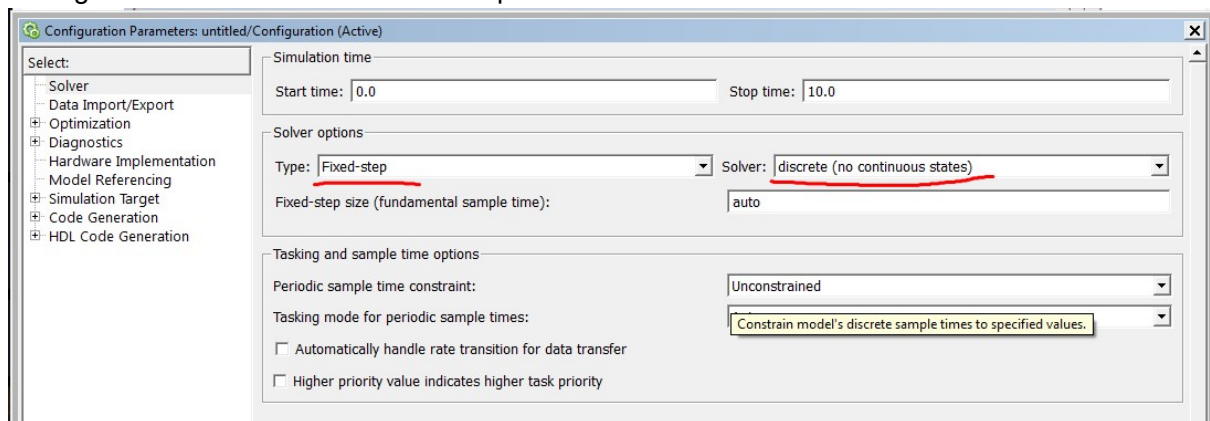
1. Objective

Students should implement basic digital systems in the Simulink environment

2. Theoretical aspects

1. Introduction to Simulink

- what it is
- how to create models
- settings needed for discrete models and simulation. Open menu Simulation -> Model Configuration Parameters and set the options as shown below.

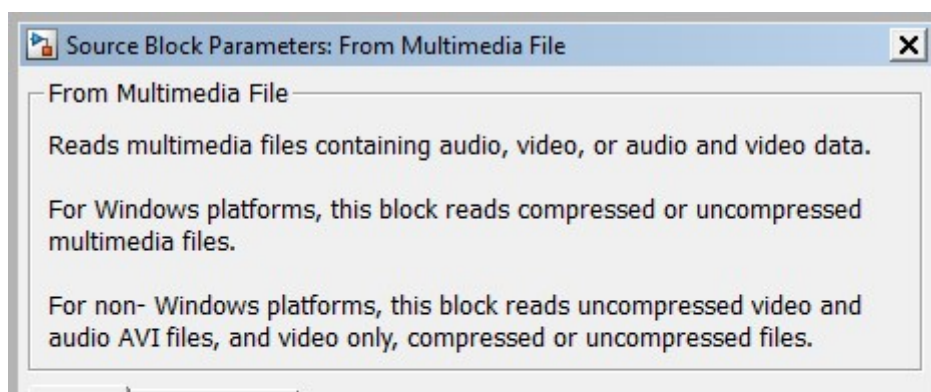


1. Basic Simulink blocks for digital signal processing

- mathematical operations: sum, product, gain
- unit delays
- input data: unit step, ramp etc
- multimedia data: FromMultimediaFile, ToAudioSink
- visualization: Scope
- miscellaneous: Manual Switch, Switch
- saving data to/from Matlab environment: ToWorkspace, FromWorkspace

1. Special settings needed for the *From Multimedia Device* block

- See below in the two figures



Main | Data Types |

Parameters

File name: C:\Users\Public\Music\Sample Music\Kalimba.mp3 Browse...

☒ Inherit sample time from file

Number of times to play file: inf

Outputs

☐ Output end-of-file indicator

Samples per audio channel: 1

Audio output sampling mode: Sample based

? OK Cancel Help Apply

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Source Block Parameters: From Multimedia File

From Multimedia File

Reads multimedia files containing audio, video, or audio and video data.

For Windows platforms, this block reads compressed or uncompressed multimedia files.

For non- Windows platforms, this block reads uncompressed video and audio AVI files, and video only, compressed or uncompressed files.

Main | Data Types |

Parameters

Audio output data type: double

? OK Cancel Help Apply

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3. Exercises

1. Create a Simulink model to implement the following system H_1 :

$$y[n] = H_1\{x[n]\} = \frac{1}{4}(x[n] + x[n-1] + x[n-2] + x[n-3])$$

- the system should be implemented as a Subsystem block with one input and one output signal

1. Visualize the impulse response of the system

- add a unit impulse as the input (hint: can be created from two unit ramp blocks, delayed)
- add a Scope at the output to visualize the data
- also save the data to workspace (ToWorkspace block) and plot the impulse response from the command line

1. Apply the system to the audio data (mp3 file) loaded with FromMultimediaFile and play the resulting output (ToAudioSink). How is the sound affected?

- make sure you set the properties of the *From Multimedia File* block as shown above

4. Final questions

1. TBD

TBD