Realize Your Product Promise®

Model-Based Design
with
SCADE Suite®

Training Activities

Day 1

ANSYS

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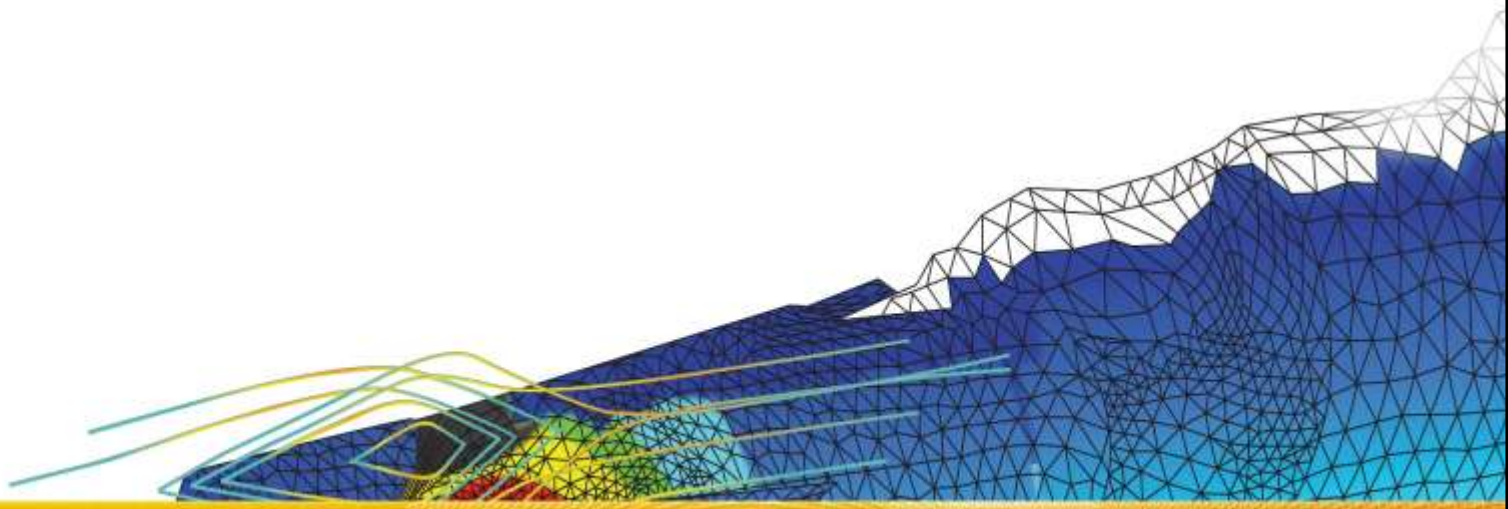
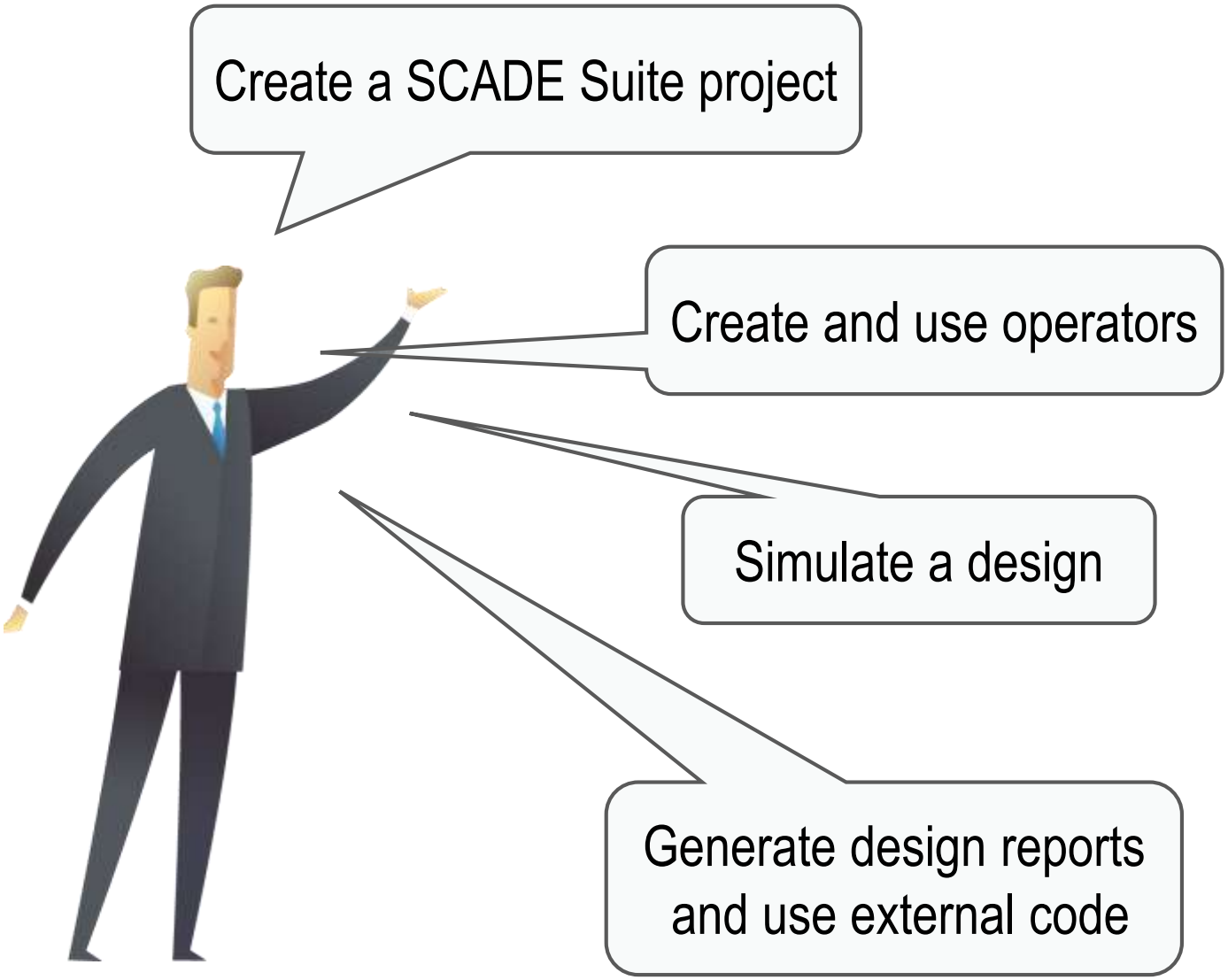
Model-Based Design with SCADE Suite

Lab Support Day 1



Lab Objectives

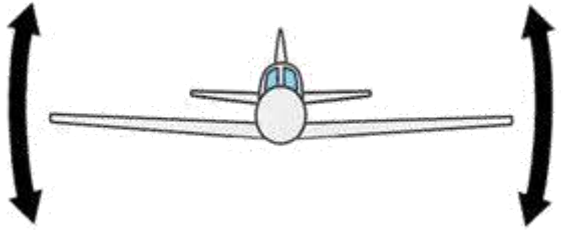
Lab



Lab Objectives

The system contains three subsystems:

- The control part to define the system mode
- The roll calculation
- A warning information when the roll is higher than a determined value



What is the roll?

The roll is the rotation around the front-to-back axis

The subsystems will be integrated together:

- We will create bricks and assemble them to obtain the whole application
- A graphical panel will be used to improve the simulation

Lab

Lab 1

Lab 1: SCADE Suite Project

Lab

Objective:

Create your first SCADE Suite project

Requirements:

Time: 10 min

Select a working folder

Open SCADE Suite and create your first project:

Project Name: RollControl

SCADE Suite libraries: libpwlinear, libmath, libdigital

Lab 1: Create your SCADE Suite Project

Select your working folder

Open SCADE Suite and create your first project

- **Project Name:** RollControl
- **SCADE Suite libraries:** libpwlinear, libmath, libdigital

Lab Solution

Lab 1: How to Create a New Project (1/3)

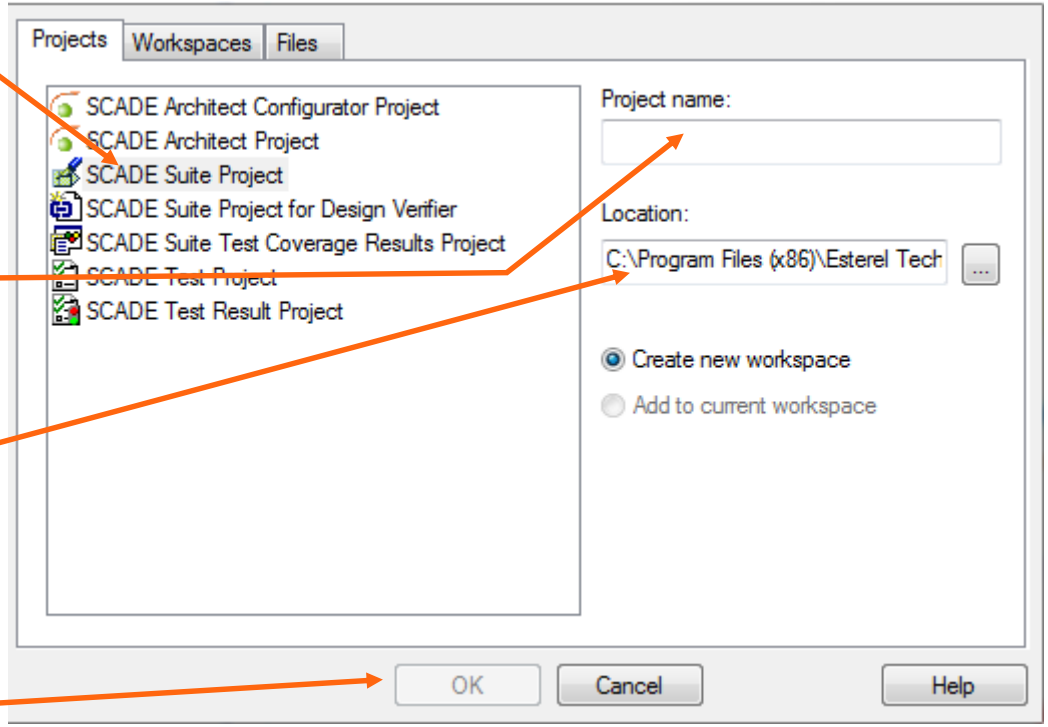
1. Launch SCADE Suite and select File - New

2. Select SCADE Suite Project

3. Enter project name

4. Enter a project location

5. Click *OK*



Lab Solution

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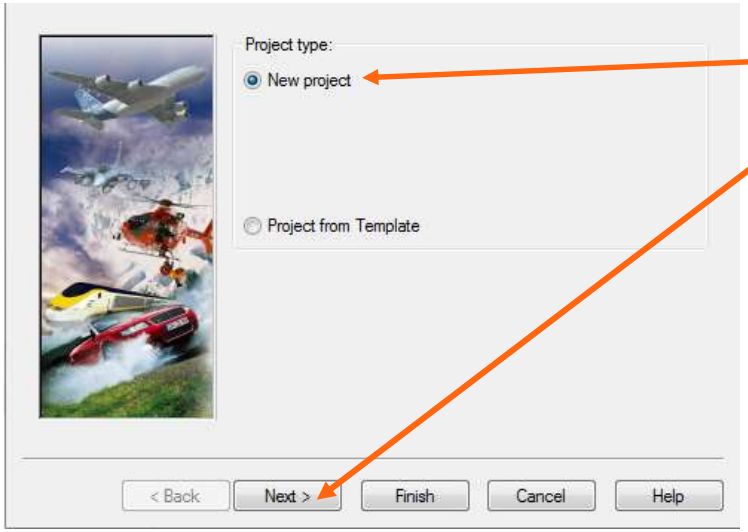
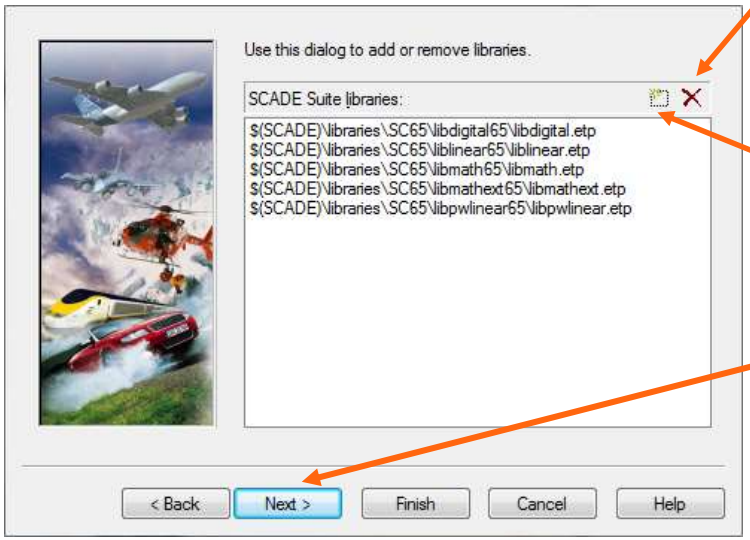
Lab 1: How to Create a New Project (2/3)



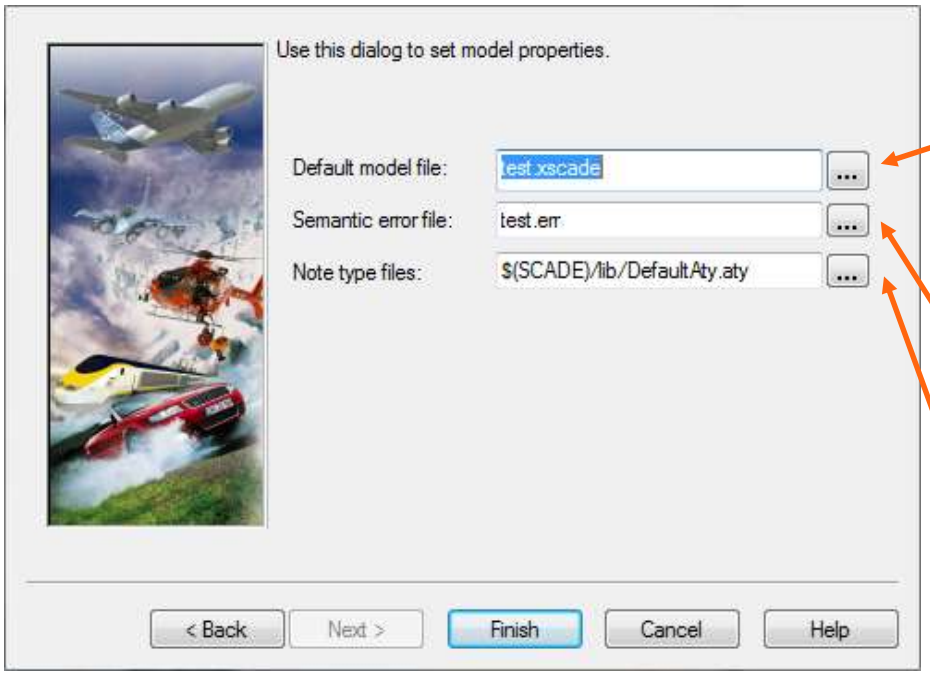
1. Select *New project*, and click on *Next*

2. Select the default SCADE Suite libraries you do not need and remove them using the  button



3. Add your own libraries by clicking on the  button and click on *Next*

Lab 1: How to Create a New Project (3/3)



Set the saving format (ensures editor compatibility with earlier versions)

Pathname of the error file

Pathname of the note type file

Click on Finish : the project with the workspace will be created automatically

Lab Solution

Lab 2

Lab 2: SCADE Suite Operator

Lab

Objective:

Create your first SCADE Suite Operator

Requirements:

Continue on the current project (RollControl.etp)

Create a new package, a new operator and add I/Os

Package Name: RollRate

Operator Name: RollRateWarning

Time: 10 min

Name	Kind	Type
rollRate	input	float32
leftWarning	output	bool
rightWarning	output	bool

Double click on the operator to open the design view

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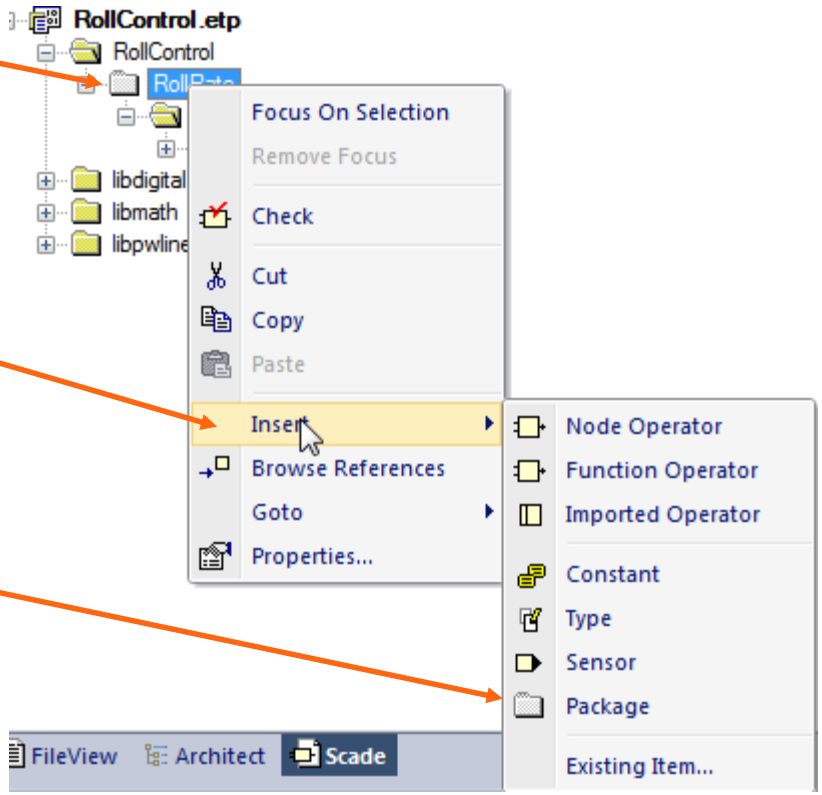
Lab 2: How to Create a New Package

1. Right click on folder or package

2. Select *Insert > Package*

3. Name your Package



Lab Solution

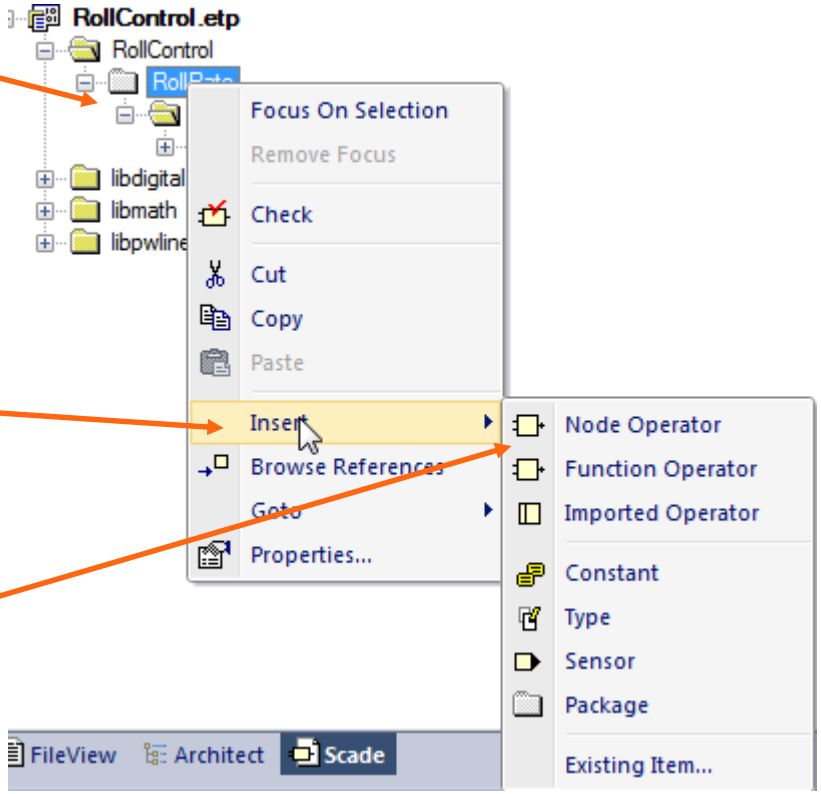
Lab 2: How to Create a New Operator

Lab Solution

1. Right click on folder/package

2. Select *Insert > Node Operator* or *Function Operator*

3. Name your Operator



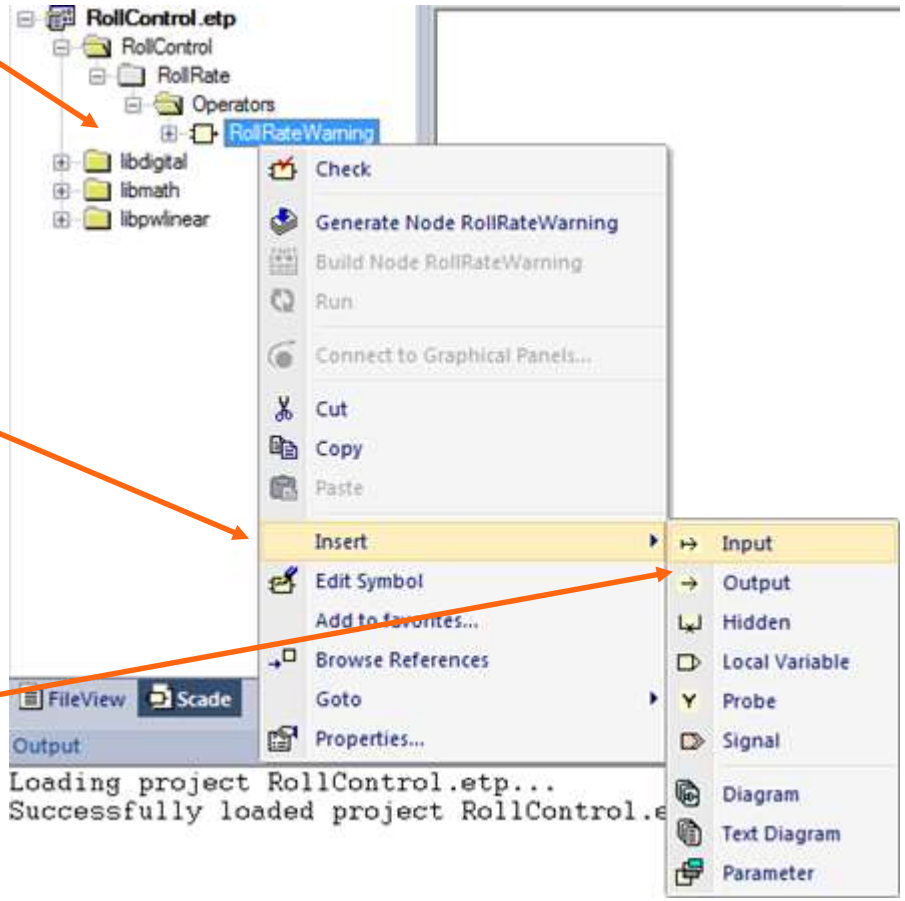
Lab 2: How to Add I/Os to Operator

Lab Solution

1. Right click on operator

2. Select *Insert > Input* or *Output*

3. Name your I/Os

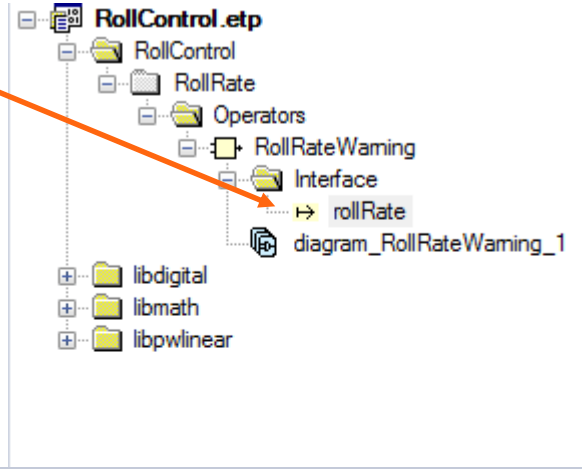


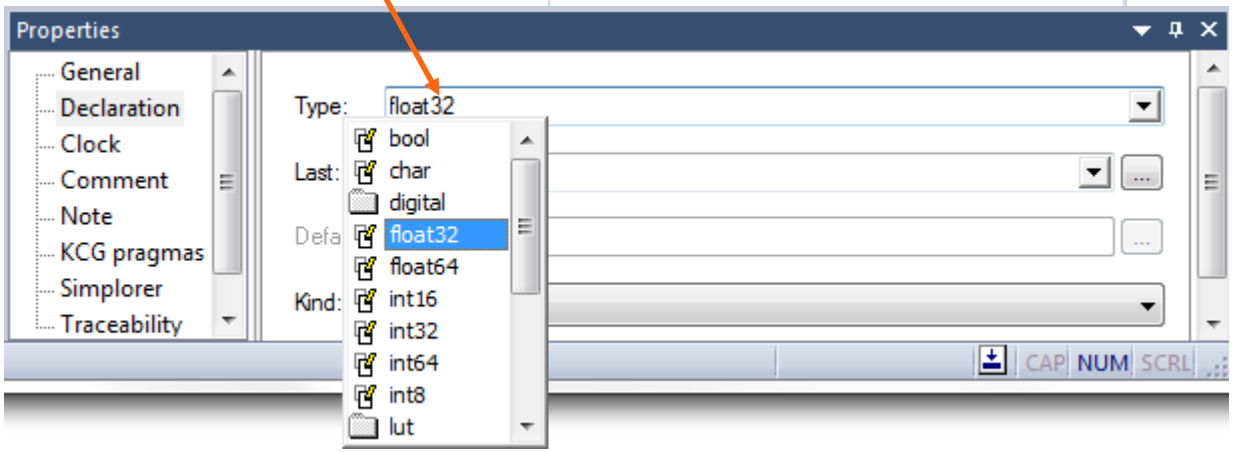
Lab 2: How to Type I/Os

Lab Solution

1. Select an I/O

2. In the properties window, select the type





Lab 3

Lab 3: Workspace

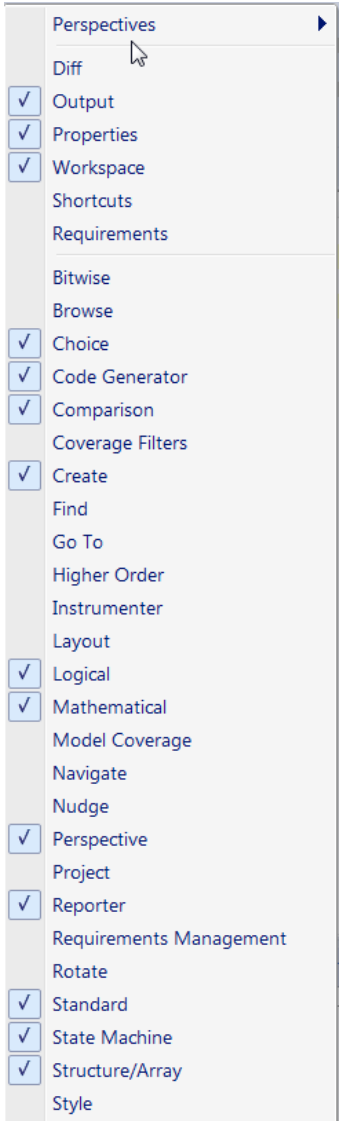
Time: 5 min

Objective:

Organize your workspace

Requirements:

Right click on the toolbars area to select the same options as on the menu on the right



Lab

Lab 4

Lab 4: Create your First Design

Lab

Objective:

Design the operator `RollRateWarning`, which computes the left warning and right warning alarms according to the airplane roll rate

Time: 10 min

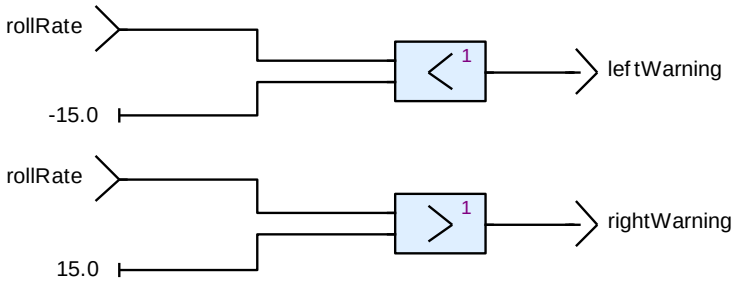
Requirement:

The operator `RollRateWarning` shall check the roll rate input and signaling if the value is out of bounds:

- when roll rate < -15.0, the operator indicates left warning
- when roll rate > 15.0, the operator indicates right warning

Tips: use  predefined operators

and  textual expression



Lab 4: Create your First Design

Lab Solution

Open the RollRateWarning operator graphical view (double click on the operator in the Scade view)

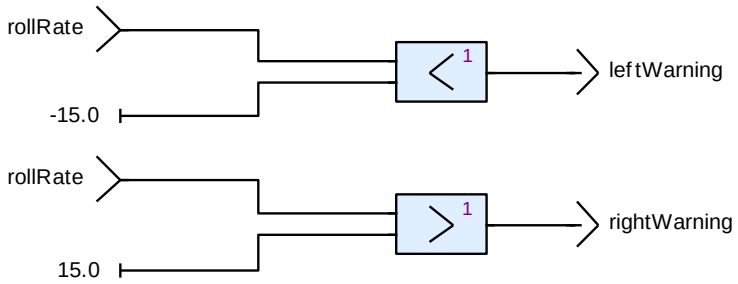
Drag and drop I/Os in the graphical view

Add  and  predefined operator (click on operator in toolbar or shortcut view and click on graphical view to create operator instance)

Use  (textual expression) to create limit value for warning enable (-15.0 and 15.0)

Connect I/Os and operators

Check and save your design



Lab 5

Lab 5: Comment your Design

Lab

Objective:

Improve the readability of `RollRateWarning` design

Requirements:

Time: 10 min

In your `RollRateWarning` operator design, add

- a comment on the `RollRateWarning` **operator** to describe the behaviour
- Notes on `RollRateWarning` **diagram** to complete information: “Title”, “Author”, and “Text In Frame”

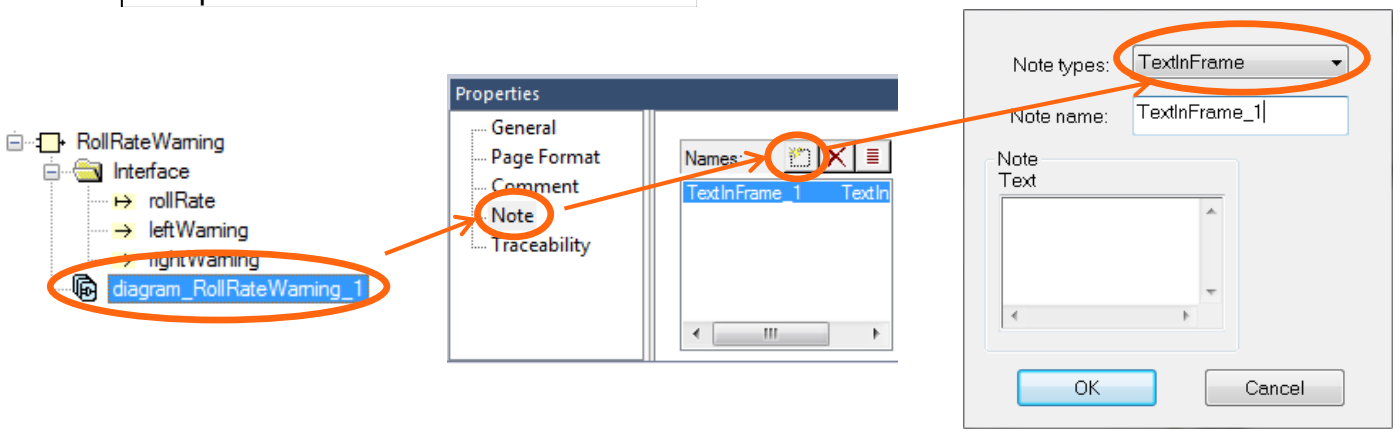
Lab 5: Comment your Design

Lab Solution

Add a comment on the `RollRateWarning` operator:

- The operator checks the roll rate input and signaling if the value is out of bounds [-15.0 ; 15.0]
- Create a “Title” and “Author” note on the diagram of the RollRateWarning
- Create a “Text in frame” note on the diagram of the RollRateWarning: “The operator checks the roll rate “

Title : RollRateWarning
Created by : ESTEREL Technologies
The operator checks the roll rate



Lab 6

Lab 6: Use Type and if-then-else (1/2)

Lab

Objective:

Design the operator `RollRateMode`, which manages the mode

Requirements:

The RollRate system has 3 modes: off, nominal, failsoft

- off mode is when ON button is not pressed
- nominal roll rate is [-25.0;25.0]
- failsoft mode is out of these boundaries

Operator Name: `RollRateMode`

Name	Kind	Type
rollRate	input	float32
onButtonIsPressed	input	bool
mode	output	teRollMode

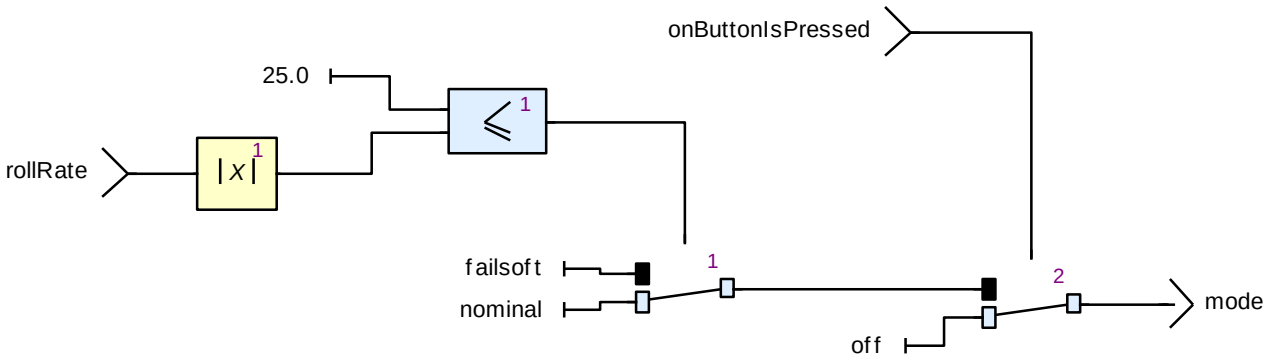
Lab 6: Use Type and if-then-else (2/2)

Create a new type `teRollMode` in the `RollRate` package:

Type	Definition
teRollMode	<enumeration>
off	
nominal	
failsoft	

Time: 10 min

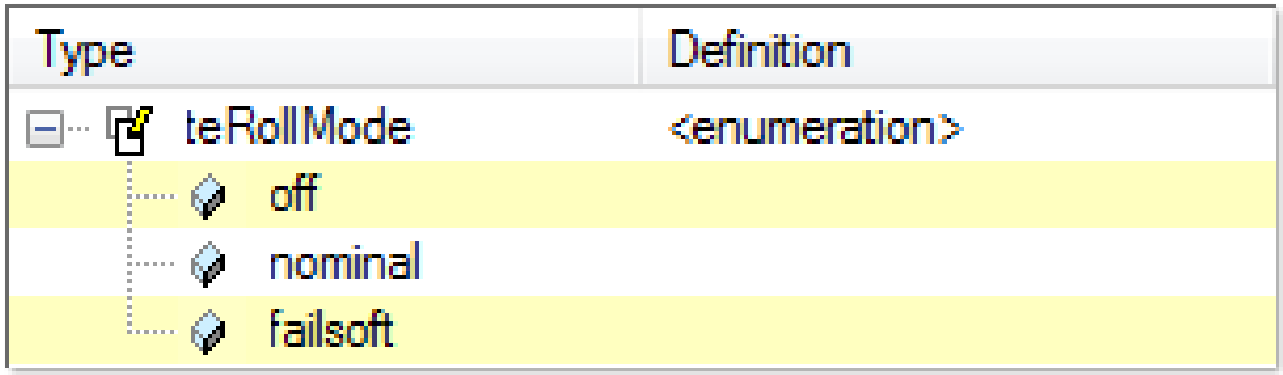
Design the `RollRateMode` operator



Tips: Use "`math : Abs`" library operator to design the `RollRateMode` operator

Lab 6: Use Type and if-then-else

Create a new type `teRollMode` in `RollRate` package

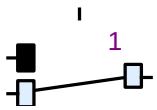
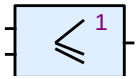


Lab Solution

Lab 6: Use Type and if-then-else

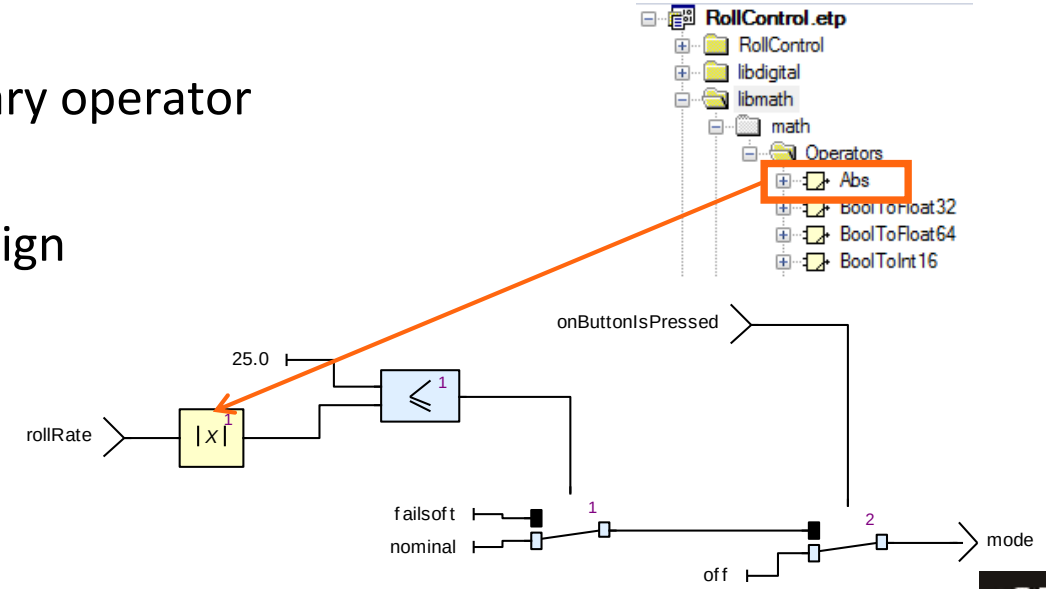
Create a new operator `RollRateMode` in `RollRate` package

- Inputs: `rollRate` (type: float32)
  `onButtonIsPressed` (type: bool)
- Output: `mode` (type: teRollMode)

Use  and  operators to determine the mode.

Use "`math::Abs`" library operator

Check and save your design



Lab 7

Lab 7: Use SCADE Suite Libraries (1/2)

Lab

Objective:

Design the operator `RollRateCalculate`, which computes the airplane roll rate depending on the joystick command's input

Requirement:

The operator `RollRateCalculate` shall limit the joystick command between -25.0 and 25.0 and indicate if the output is saturated

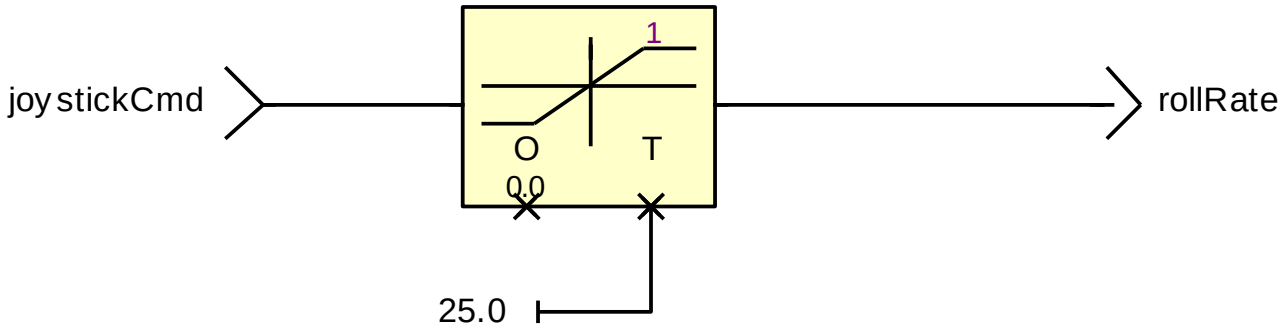
Operator Name: `RollRateCalculate`

Name	Kind	Type
joystickCmd	input	float32
rollRate	output	float32

Lab 7: Use SCADE Suite Libraries (1/2)

Design the `RollRateCalculate` operator

Time: 10 min



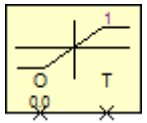
Lab

Lab 7: Use SCADE Suite Libraries

Create a new operator RollRateCalculate in the RollRate package:

- Input: joystickCmd (type: float32)
- Outputs: rollRate (type: float32)

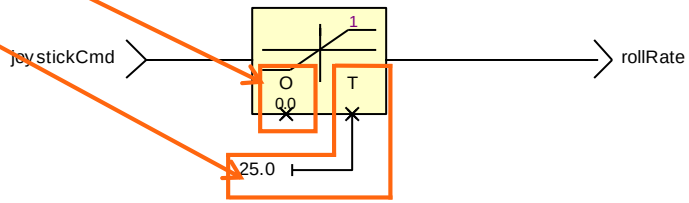
Drag and drop I/Os in the graphical view

Use “pwlinear::LimiterSymmetrical” 

operator to limit the roll rate, with the following hidden input:

- Band Origin= 0.0
- Tolerance = 25.0

Connect I/Os and operators



Check and save your design

Lab 8

Lab 8: Connect Operators (1/2)

Lab

Objective:

Design the architecture operator `RollRate`

Requirements:

Create the `RollRate` operator and connects the previous designed operators to manage the system

Operator Name: `RollRate`

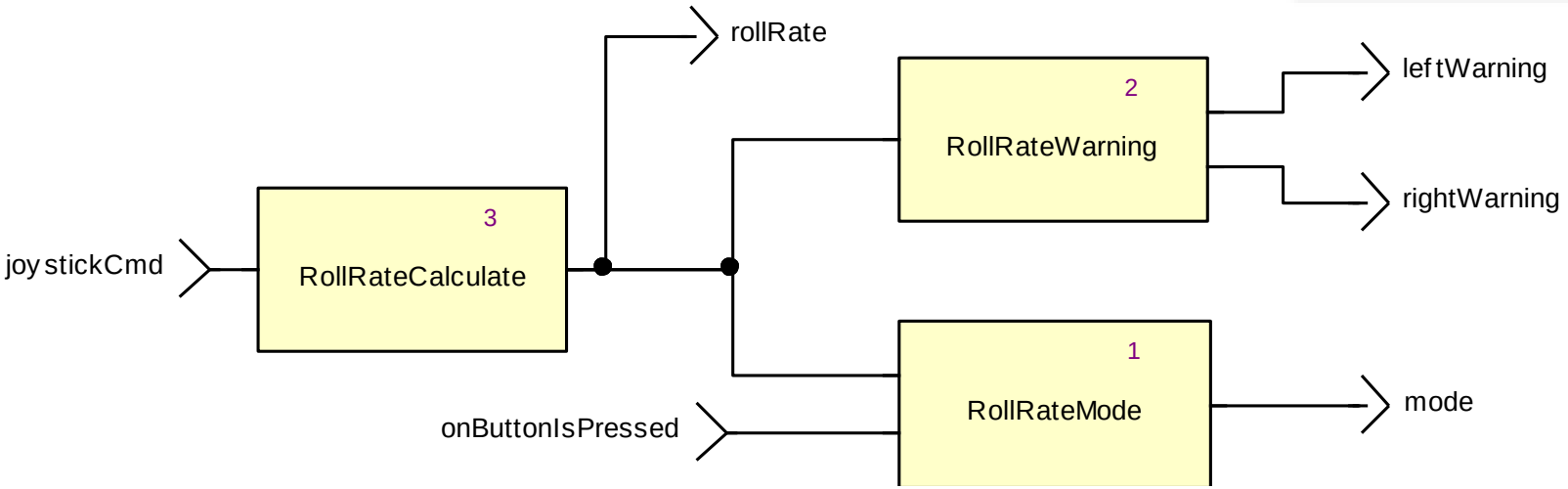
Name	Kind	Type
joystickCmd	input	float32
onButtonIsPressed	input	bool
rollRate	output	float32
mode	output	teRollMode
rightWarning	output	Bool
leftWarning	output	bool

Lab 8: Connect Operators (2/2)

Use Lab Support p.34-36

Design the `RollRate` operator

Time: 10 min



Lab

Lab 8: Connect the Operators

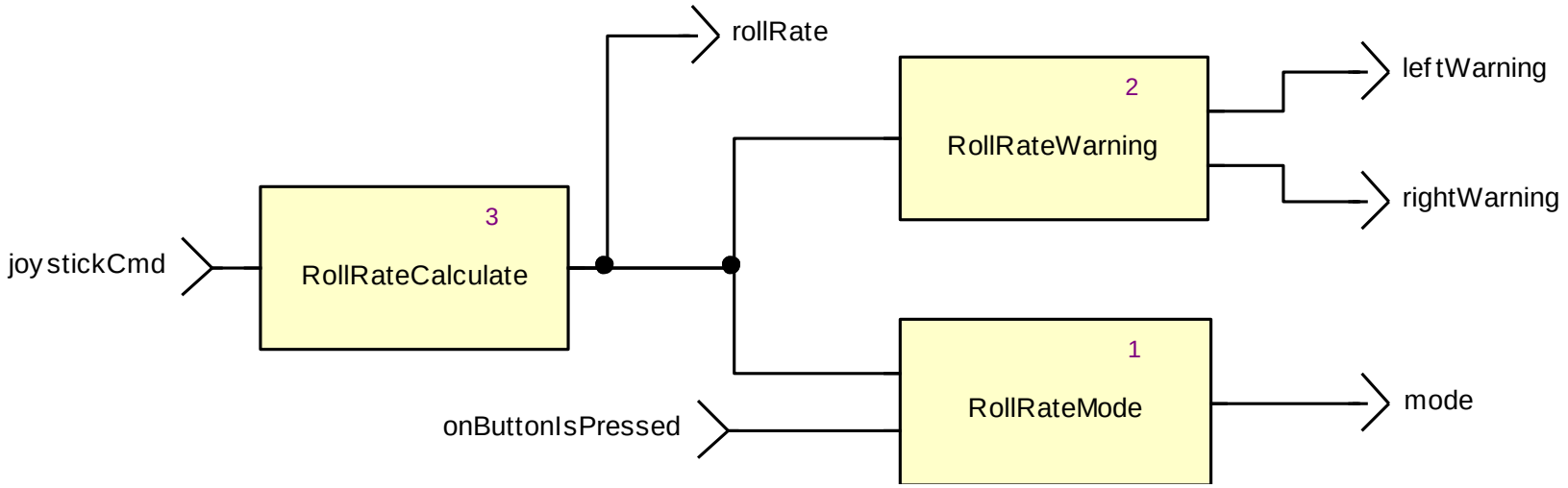
Create a new operator "`RollRate`" in `RollRate` package:

- Inputs: `joystickCmd` (type: float32)
  `onButtonIsPressed` (type: bool)
- Outputs: `rollRate` (type: float32)
  `mode` (type: teRollMode)
  `rightWarning` (type: bool)
  `leftWarning` (type: bool)

Lab Solution

Lab 8: Connect the Operators

Drag and drop I/Os and the three operators previously created in the graphical view and connect them together



Lab Solution

Lab 9

Lab 9: SCADE Suite Simulator

Lab

Objective:

Simulate RollRate system to check the design

Requirements:

Generate the code and run the simulation

Time: 10 min

Play with the features of the SCADE Suite Simulator:

- Change the inputs values
- Run step by step or in continuous mode
- Open the watch window and select a data to observe (right click and select add to watch or drag and drop it to the watch window)
- Play the simulation in the graph window…

Lab 10

Lab 10: Generate KCG C Code

Lab

Objective:

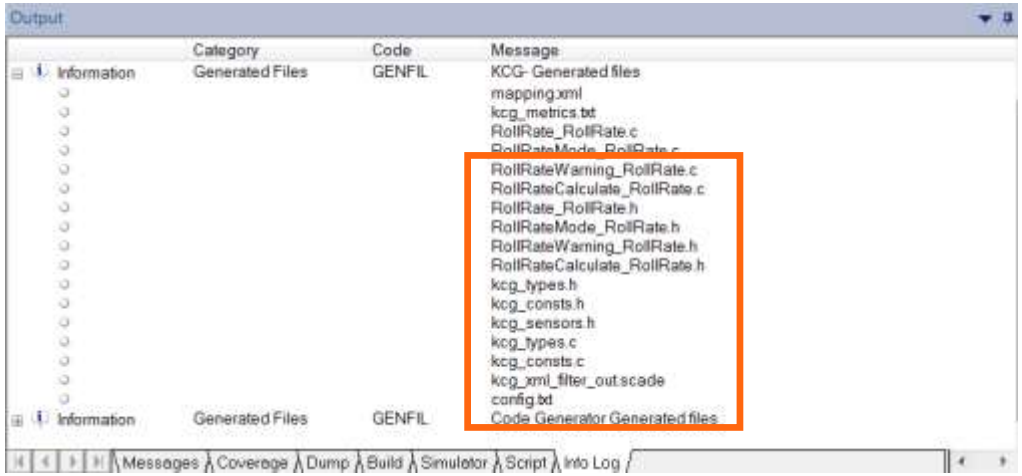
Generate KCG code and observe generated files

Requirements:

Generate the code with KCG configuration

Observe the generated files:

Time: 10 min



Lab 10: Generate KCG Ada Code

Ada

Objective:

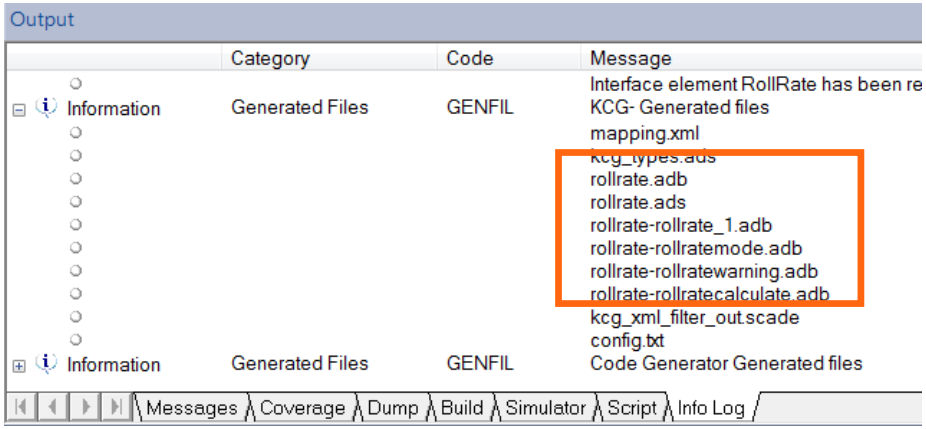
Generate KCG Ada code and observe generated files

Requirements:

Time: 10 min

Generate the code with KCGAda configuration

Observe the generated files:



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Lab 11 (C code Only)

Lab 11: Create a Standalone Executable (C Code)

Lab

Objective:

Generate a Standalone Executable with a Graphical Panel

Time: 5 min

Requirements:

Select the “Standalone Executable” configuration (C code)

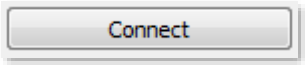
Generate and execute the executable

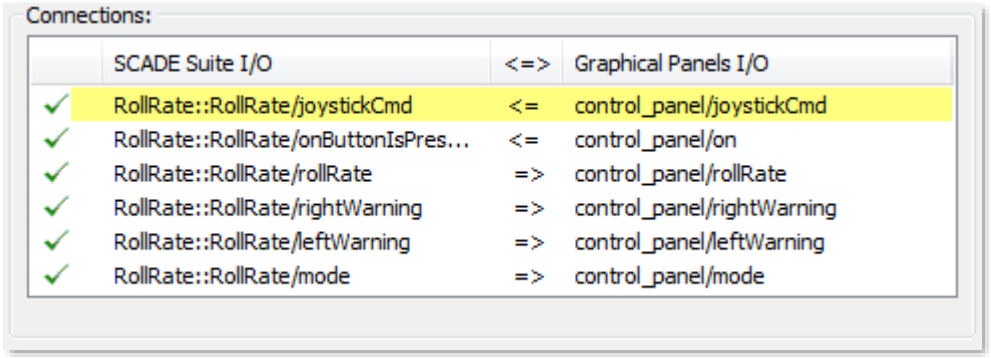
Lab 11: Prerequisites

Add a Rapid Prototyper Panel in your SCADE Suite design:

- In fileView, right click on RollControl.etp, in the File View , and select Insert File …
- Select Prerequisites\Lab11\Graphical Panel\rollRateGP.etp
- In ScadeView, right click on the RollRate operator, in the Scade View, and select Connect to Graphical Panel …

- Connect SCADE Suite I/Os with Graphical Panel I/Os





Lab Prerequisite

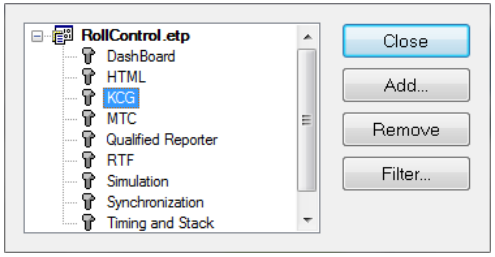
Lab 11: Prerequisites

Lab Prerequisite

Configurations allow you to save different code generation-simulator/reporter options for different purposes for the same project

Create a new configuration allowed for the Standalone Executable generation:

- Click on Project > Configurations
- Click on KCG and Add…
- Enter the new name “Standalone Executable”
- Click on OK > Close



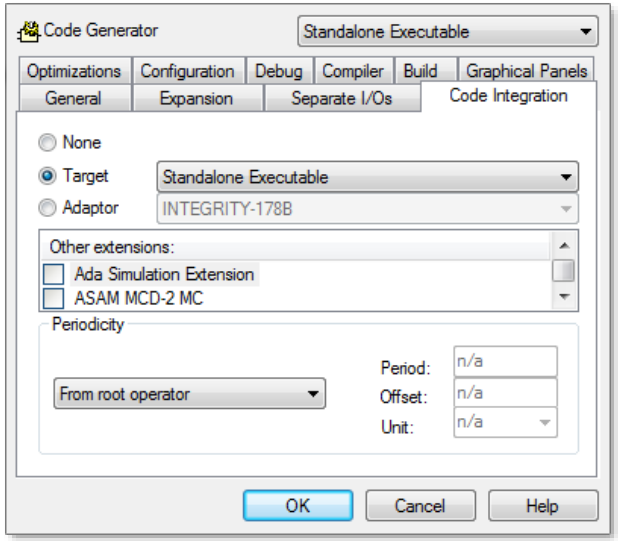
Lab 11: Prerequisites

Lab Prerequisite

Set the new configuration:

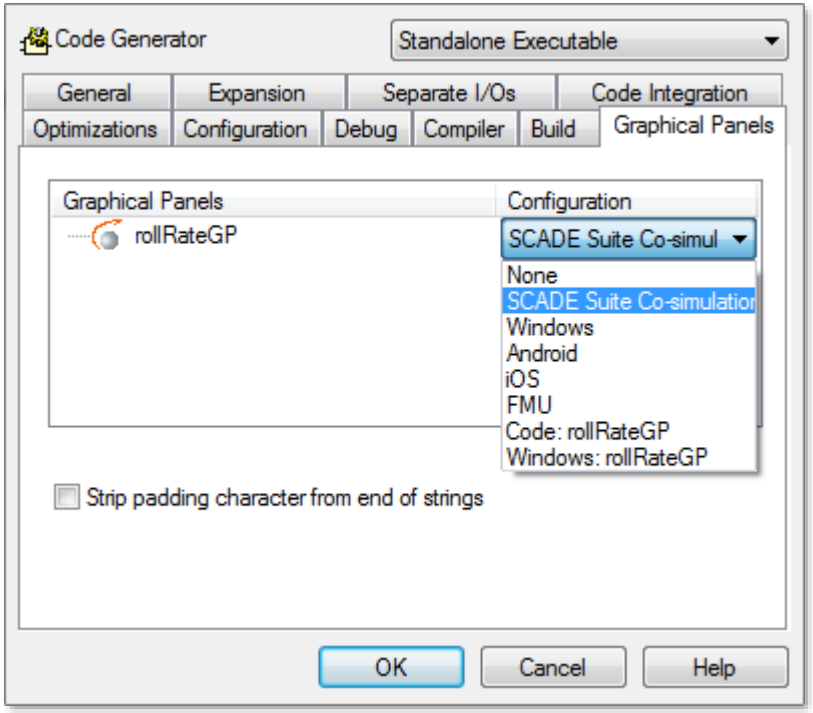
- Select Standalone Executable and click on Settings…

- Click on the Code Integration tab
- Select *Target > Standalone Executable*



Lab 11: Prerequisites

- Click on the Graphical Panel tab
- Select SCADE Suite Co-Simulation
- Click on OK



Lab 11: Solution

Lab Prerequisite

Select RollRate operator

Select the Standalone Executable configuration in Code Generator toolbar.

Generate and build the code.

Open the directory:
Standalone Executable\standalone and execute rollRateGP.exe.

Lab 12

Lab 12: Generate a Design Report

Lab

Objective:

Generate a RTF report of your design

Requirements:

Time: 10 min

Select RTF format and generate a design report

Open the generated report

Change settings and regenerate: observe the differences

Contacts

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