sldemo_househeat

Design Description

GM

sldemo_househeat: Design Description

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Chapter 2. Root System

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Figure 2.1. sldemo_househeat
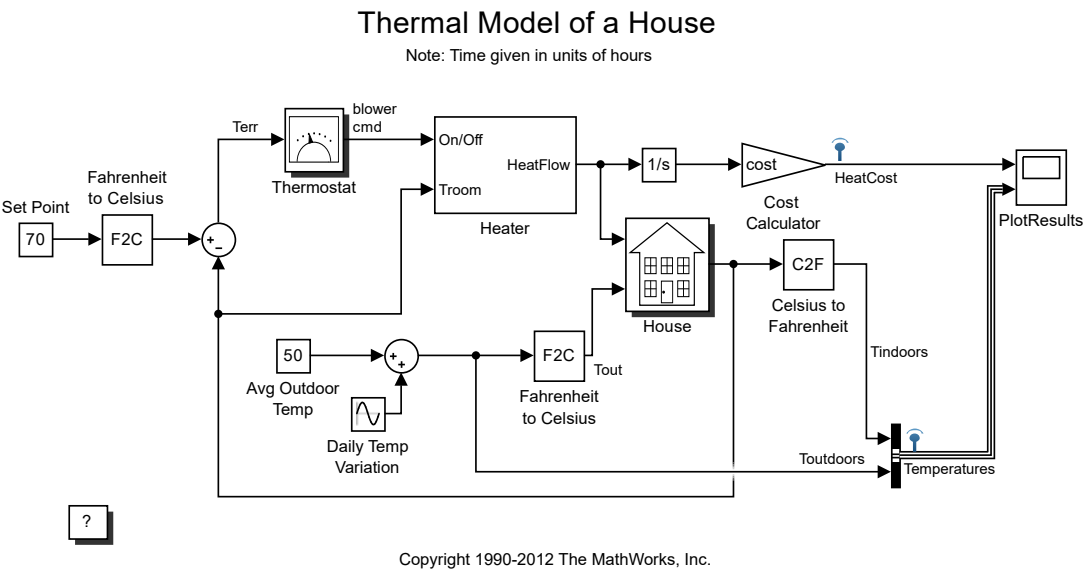
2.1. Description

Thermal Model of a House This demo illustrates how you can use Simulink(R) to create the thermal model of a house. This system models the outdoor environment, the thermal characteristics of the house, and the house heating system. The sldemo_househeat_data.m file initializes data in the model workspace. To make changes, you can edit the model workspace directly or edit the MATLAB(R) file and re-load the model workspace. To view the model workspace, select View > Model Explorer from the Simulink editor. Note: Time is given in units of hours

2.2. Blocks

2.2.1. Parameters

2.2.1.1. "Avg Outdoor Temp" (Constant)

Table 2.1. "Avg Outdoor Temp" Parameters

Parameter	Value
Constant value	50
Interpret vector parameters as 1-D	on
Output minimum	[]
Output maximum	[]
Output data type	Inherit: Inherit from 'Constant value'
Lock output data type setting against changes by the fixed-point tools	off
Sample time	inf
Frame period	inf

2.2.1.2. "Bus Creator" (BusCreator)

Table 2.2. "Bus Creator" Parameters

Parameter	Value
Number of inputs	2
Display option	bar
Data type	Inherit: auto
Output as nonvirtual bus	off
Override bus signal names from inputs	on

2.2.1.3. "Cost Calculator" (Gain)

Table 2.3. "Cost Calculator" Parameters

Parameter	Value
Gain	cost
Multiplication	Element-wise(K.*u)
Parameter minimum	[]
Parameter maximum	[]
Parameter data type	Inherit: Same as input
Output minimum	[]
Output maximum	[]

Parameter	Value
Output data type	Inherit: Same as input
Lock output data type setting against changes by the fixed-point tools	off
Integer rounding mode	Floor
Saturate on integer overflow	on
Sample time (-1 for inherited)	-1

2.2.1.4. "Daily Temp Variation" (Sin)

Table 2.4. "Daily Temp Variation" Parameters

Parameter	Value
Sine type	Time based
Time (t)	Use simulation time
Amplitude	15
Bias	0
Frequency (rad/sec)	2*pi/24
Phase (rad)	0
Samples per period	10
Number of offset samples	0
Sample time	0
Interpret vector parameters as 1-D	on

2.2.1.5. "Integrator" (Integrator)

Table 2.5. "Integrator" Parameters

Parameter	Value
External reset	none
Initial condition source	internal
Initial condition	0
Limit output	off
Upper saturation limit	inf
Lower saturation limit	-inf
Wrap state	off

Parameter	Value
Wrapped state upper value	pi
Wrapped state lower value	-pi
Show saturation port	off
Show state port	off
Ignore limit and reset when linearizing	off
Enable zero-crossing detection	on
State Name (e.g., 'position')	''

2.2.1.6. "Set Point" (Constant)

Table 2.6. "Set Point" Parameters

Parameter	Value
Constant value	70
Interpret vector parameters as 1-D	on
Output minimum	[]
Output maximum	[]
Output data type	Inherit: Inherit from 'Constant value'
Lock output data type setting against changes by the fixed-point tools	off
Sample time	inf
Frame period	inf

2.2.1.7. "Sum" (Sum)

Table 2.7. "Sum" Parameters

Parameter	Value
Icon shape	round
List of signs	+-|
Sum over	All dimensions
Dimension	1
Require all inputs to have the same data type	on

Parameter	Value
Accumulator data type	Inherit: Inherit via internal rule
Output minimum	[]
Output maximum	[]
Output data type	Inherit: Same as first input
Lock data type settings against changes by the fixed-point tools	off
Integer rounding mode	Floor
Saturate on integer overflow	on
Sample time (-1 for inherited)	-1

2.2.1.8. "Sum1" (Sum)

Table 2.8. "Sum1" Parameters

Parameter	Value
Icon shape	round
List of signs	|++
Sum over	All dimensions
Dimension	1
Require all inputs to have the same data type	on
Accumulator data type	Inherit: Inherit via internal rule
Output minimum	[]
Output maximum	[]
Output data type	Inherit: Same as first input
Lock data type settings against changes by the fixed-point tools	off
Integer rounding mode	Floor
Saturate on integer overflow	on
Sample time (-1 for inherited)	-1

2.2.2. Block Execution Order

1. Integrator [19] (Integrator)

2. Gain [10] (Gain)
3. Constant [9] (Constant)
4. Sum [10] (Sum)
5. Avg Outdoor Temp [2] (Constant)
6. Daily Temp Variation [4] (Sin)
7. Sum1 [6] (Sum)
8. HiddenToWks_InsertedFor_Bus Creator_at_outport_0_1 (ToWorkspace)
9. Integrator [4] (Integrator)
10. Cost Calculator [3] (Gain)
11. HiddenToWks_InsertedFor_Cost Calculator_at_outport_0 (ToWorkspace)
12. PlotResults [5] (Scope)
13. Constant [12] (Constant)
14. Sum [13] (Sum)
15. Gain1 [13] (Gain)
16. Constant (Constant)
17. Set Point [5] (Constant)
18. Sum (Sum)
19. Gain1 (Gain)
20. Heater Air Temperature [14] (Constant)
21. Sum2 [17] (Sum)
22. HeatGain [16] (Gain)
23. Sum [5] (Sum)
24. Relay1 [23] (Relay)
25. Heater Switch [14] (Product)
26. Sum2 [22] (Sum)
27. Heat Losses [18] (Gain)
28. Sum1 [21] (Sum)
29. 1/Mc [18] (Gain)

Chapter 3. Subsystems

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3.1. Celsius to Fahrenheit

Figure 3.1. sldemo_househeat/Celsius to Fahrenheit
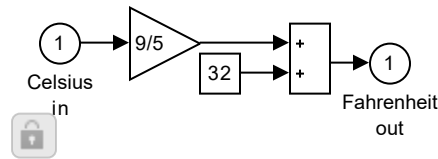
3.1.1. Blocks

3.1.1.1. Parameters

3.1.1.1.1. "Celsius in" (Inport)

Table 3.1. "Celsius in" Parameters

Parameter	Value
Port number	1
Port dimensions (-1 for inherited)	-1
Sample time (-1 for inherited)	-1
Minimum	[]
Maximum	[]
Data type	Inherit: auto

3.1.1.1.2. "Constant" (Constant)

Table 3.2. "Constant" Parameters

Parameter	Value
Constant value	32
Interpret vector parameters as 1-D	on
Output minimum	[]
Output maximum	[]
Output data type	Inherit: Inherit via back propagation
Lock output data type setting against changes by the fixed-point tools	off
Sample time	inf
Frame period	inf

3.1.1.1.3. "Fahrenheit out" (Outport)

Table 3.3. "Fahrenheit out" Parameters

Parameter	Value
Port number	1
Icon display	Port number
Minimum	[]
Maximum	[]
Data type	Inherit: auto
Lock output data type setting against changes by the fixed-point tools	off
Output as nonvirtual bus in parent model	off
Unit (e.g., m, m/s^2, N*-m)	inherit
Port dimensions (-1 for inherited)	-1
Variable-size signal	Inherit
Sample time (-1 for inherited)	-1
Ensure outport is virtual	off
Source of initial output value	Dialog

Parameter	Value
Output when disabled	held
Initial output	0

3.1.1.1.4. "Gain" (Gain)

Table 3.4. "Gain" Parameters

Parameter	Value
Gain	9/5
Multiplication	Element-wise(K.*u)
Parameter minimum	[]
Parameter maximum	[]
Parameter data type	Inherit: Same as input
Output minimum	[]
Output maximum	[]
Output data type	Inherit: Same as input
Lock output data type setting against changes by the fixed-point tools	off
Integer rounding mode	Floor
Saturate on integer overflow	on
Sample time (-1 for inherited)	-1

3.1.1.1.5. "Sum" (Sum)

Table 3.5. "Sum" Parameters

Parameter	Value
Icon shape	rectangular
List of signs	++
Sum over	All dimensions
Dimension	1
Require all inputs to have the same data type	on
Accumulator data type	Inherit: Inherit via internal rule
Output minimum	[]
Output maximum	[]

Parameter	Value
Output data type	Inherit: Same as first input
Lock data type settings against changes by the fixed-point tools	off
Integer rounding mode	Floor
Saturate on integer overflow	on
Sample time (-1 for inherited)	-1

3.2. Fahrenheit to Celsius

Figure 3.2. sldemo_househeat/Fahrenheit to Celsius
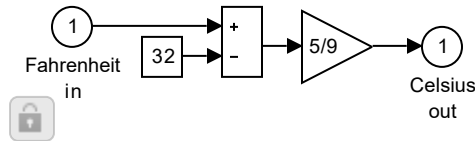
3.2.1. Blocks

3.2.1.1. Parameters

3.2.1.1.1. "Celsius out" (Outport)

Table 3.6. "Celsius out" Parameters

Parameter	Value
Port number	1
Icon display	Port number
Minimum	[]
Maximum	[]
Data type	Inherit: auto
Lock output data type setting against changes by the fixed-point tools	off
Output as nonvirtual bus in parent model	off
Unit (e.g., m, m/s^2, N*-m)	inherit
Port dimensions (-1 for inherited)	-1

Parameter	Value
Variable-size signal	Inherit
Sample time (-1 for inherited)	-1
Ensure outport is virtual	off
Source of initial output value	Dialog
Output when disabled	held
Initial output	0

3.2.1.1.2. "Constant" (Constant)

Table 3.7. "Constant" Parameters

Parameter	Value
Constant value	32
Interpret vector parameters as 1-D	on
Output minimum	[]
Output maximum	[]
Output data type	Inherit: Inherit via back propagation
Lock output data type setting against changes by the fixed-point tools	off
Sample time	inf
Frame period	inf

3.2.1.1.3. "Fahrenheit in" (Inport)

Table 3.8. "Fahrenheit in" Parameters

Parameter	Value
Port number	1
Port dimensions (-1 for inherited)	-1
Sample time (-1 for inherited)	-1
Minimum	[]
Maximum	[]
Data type	Inherit: auto

3.2.1.1.4. "Gain1" (Gain)

Table 3.9. "Gain1" Parameters

Parameter	Value
Gain	5/9
Multiplication	Element-wise(K.*u)
Parameter minimum	[]
Parameter maximum	[]
Parameter data type	Inherit: Same as input
Output minimum	[]
Output maximum	[]
Output data type	Inherit: Same as input
Lock output data type setting against changes by the fixed-point tools	off
Integer rounding mode	Floor
Saturate on integer overflow	on
Sample time (-1 for inherited)	-1

3.2.1.1.5. "Sum" (Sum)

Table 3.10. "Sum" Parameters

Parameter	Value
Icon shape	rectangular
List of signs	+-
Sum over	All dimensions
Dimension	1
Require all inputs to have the same data type	on
Accumulator data type	Inherit: Inherit via internal rule
Output minimum	[]
Output maximum	[]
Output data type	Inherit: Same as first input
Lock data type settings against changes by the fixed-point tools	off
Integer rounding mode	Floor

Parameter	Value
Saturate on integer overflow	on
Sample time (-1 for inherited)	-1

3.3. Heater

Figure 3.3. sldemo_househeat/Heater

Heater Subsystem

3.3.1. Blocks

3.3.1.1. Parameters

3.3.1.1.1. "Heater Air Temperature" (Constant)

Table 3.11. "Heater Air Temperature" Parameters

Parameter	Value
Constant value	THeater
Interpret vector parameters as 1-D	on
Output minimum	[]
Output maximum	[]
Output data type	Inherit: Inherit from 'Constant value'
Lock output data type setting against changes by the fixed-point tools	off
Sample time	inf
Frame period	inf

3.3.1.1.2. "Heater Switch" (Product)

Table 3.12. "Heater Switch" Parameters

Parameter	Value
Number of inputs	2
Multiplication	Element-wise(.*)
Multiply over	All dimensions
Dimension	1
Require all inputs to have the same data type	off
Output minimum	[]
Output maximum	[]
Output data type	Inherit: Inherit via internal rule
Lock output data type setting against changes by the fixed-point tools	off
Integer rounding mode	Zero
Saturate on integer overflow	off
Sample time (-1 for inherited)	-1

3.3.1.1.3. "HeatFlow" (Outport)

Table 3.13. "HeatFlow" Parameters

Parameter	Value
Port number	1
Icon display	Port number
Minimum	[]
Maximum	[]
Data type	Inherit: auto
Lock output data type setting against changes by the fixed-point tools	off
Output as nonvirtual bus in parent model	off
Unit (e.g., m, m/s^2, N*-m)	inherit
Port dimensions (-1 for inherited)	-1
Variable-size signal	Inherit

Parameter	Value
Sample time (-1 for inherited)	-1
Ensure outport is virtual	off
Source of initial output value	Dialog
Output when disabled	held
Initial output	[]

3.3.1.1.4. "HeatGain" (Gain)

Table 3.14. "HeatGain" Parameters

Parameter	Value
Gain	Mdot*c
Multiplication	Element-wise(K.*u)
Parameter minimum	[]
Parameter maximum	[]
Parameter data type	Inherit: Inherit via internal rule
Output minimum	[]
Output maximum	[]
Output data type	Inherit: Inherit via internal rule
Lock output data type setting against changes by the fixed-point tools	off
Integer rounding mode	Floor
Saturate on integer overflow	off
Sample time (-1 for inherited)	-1

3.3.1.1.5. "On/Off" (Inport)

Table 3.15. "On/Off" Parameters

Parameter	Value
Port number	1
Port dimensions (-1 for inherited)	-1
Sample time (-1 for inherited)	-1
Minimum	[]

Parameter	Value
Maximum	[]
Data type	Inherit: auto

3.3.1.1.6. "Sum2" (Sum)

Table 3.16. "Sum2" Parameters

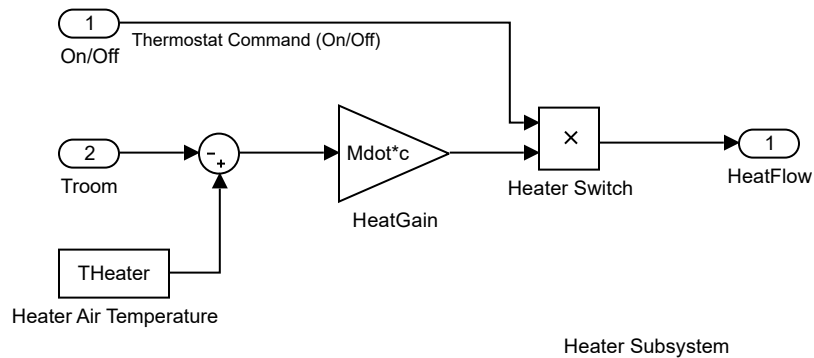| Parameter	Value
Icon shape	round
List of signs	|-+
Sum over	All dimensions
Dimension	1
Require all inputs to have the same data type	off
Accumulator data type	Inherit: Inherit via internal rule
Output minimum	[]
Output maximum	[]
Output data type	Inherit: Inherit via internal rule
Lock data type settings against changes by the fixed-point tools	off
Integer rounding mode	Floor
Saturate on integer overflow	off
Sample time (-1 for inherited)	-1

3.3.1.1.7. "Troom" (Inport)

Table 3.17. "Troom" Parameters

Parameter	Value
Port number	2
Port dimensions (-1 for inherited)	-1
Sample time (-1 for inherited)	-1
Minimum	[]
Maximum	[]
Data type	Inherit: auto

3.4. House

Figure 3.4. sldemo_househeat/House
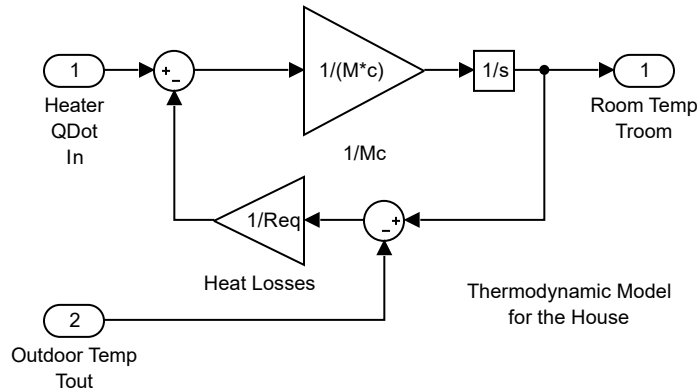
3.4.1. Blocks

3.4.1.1. Parameters

3.4.1.1.1. "1/Mc" (Gain)

Table 3.18. "1/Mc" Parameters

Parameter	Value
Gain	1/(M*c)
Multiplication	Element-wise(K.*u)
Parameter minimum	[]
Parameter maximum	[]
Parameter data type	Inherit: Same as input
Output minimum	[]
Output maximum	[]
Output data type	Inherit: Same as input
Lock output data type setting against changes by the fixed-point tools	off
Integer rounding mode	Floor
Saturate on integer overflow	on
Sample time (-1 for inherited)	-1

3.4.1.1.2. "Heat Losses" (Gain)

Table 3.19. "Heat Losses" Parameters

Parameter	Value
Gain	1/Req
Multiplication	Element-wise(K.*u)
Parameter minimum	[]
Parameter maximum	[]
Parameter data type	Inherit: Same as input
Output minimum	[]
Output maximum	[]
Output data type	Inherit: Same as input
Lock output data type setting against changes by the fixed-point tools	off
Integer rounding mode	Floor
Saturate on integer overflow	on
Sample time (-1 for inherited)	-1

3.4.1.1.3. "Heater QDot In" (Inport)

Table 3.20. "Heater QDot In" Parameters

Parameter	Value
Port number	1
Port dimensions (-1 for inherited)	-1
Sample time (-1 for inherited)	-1
Minimum	[]
Maximum	[]
Data type	Inherit: auto

3.4.1.1.4. "Integrator" (Integrator)

Table 3.21. "Integrator" Parameters

Parameter	Value
External reset	none

Parameter	Value
Initial condition source	internal
Initial condition	TinIC
Limit output	off
Upper saturation limit	inf
Lower saturation limit	-inf
Wrap state	off
Wrapped state upper value	pi
Wrapped state lower value	-pi
Show saturation port	off
Show state port	off
Ignore limit and reset when linearizing	off
Enable zero-crossing detection	on
State Name (e.g., 'position')	"

3.4.1.1.5. "Outdoor Temp Tout" (Inport)

Table 3.22. "Outdoor Temp Tout" Parameters

Parameter	Value
Port number	2
Port dimensions (-1 for inherited)	-1
Sample time (-1 for inherited)	-1
Minimum	[]
Maximum	[]
Data type	Inherit: auto

3.4.1.1.6. "Room Temp Troom" (Outport)

Table 3.23. "Room Temp Troom" Parameters

Parameter	Value
Port number	1
Icon display	Port number
Minimum	[]

Parameter	Value
Maximum	[]
Data type	Inherit: auto
Lock output data type setting against changes by the fixed-point tools	off
Output as nonvirtual bus in parent model	off
Unit (e.g., m, m/s^2, N*-m)	inherit
Port dimensions (-1 for inherited)	-1
Variable-size signal	Inherit
Sample time (-1 for inherited)	-1
Ensure outport is virtual	off
Source of initial output value	Dialog
Output when disabled	held
Initial output	0

3.4.1.1.7. "Sum1" (Sum)

Table 3.24. "Sum1" Parameters

Parameter	Value
Icon shape	round
List of signs	|+-
Sum over	All dimensions
Dimension	1
Require all inputs to have the same data type	on
Accumulator data type	Inherit: Inherit via internal rule
Output minimum	[]
Output maximum	[]
Output data type	Inherit: Same as first input
Lock data type settings against changes by the fixed-point tools	off
Integer rounding mode	Floor
Saturate on integer overflow	on

Parameter	Value
Sample time (-1 for inherited)	-1

3.4.1.1.8. "Sum2" (Sum)

Table 3.25. "Sum2" Parameters

Parameter	Value
Icon shape	round
List of signs	|+-
Sum over	All dimensions
Dimension	1
Require all inputs to have the same data type	on
Accumulator data type	Inherit: Inherit via internal rule
Output minimum	[]
Output maximum	[]
Output data type	Inherit: Same as first input
Lock data type settings against changes by the fixed-point tools	off
Integer rounding mode	Floor
Saturate on integer overflow	on
Sample time (-1 for inherited)	-1

3.5. Thermostat

Figure 3.5. sldemo_househeat/Thermostat
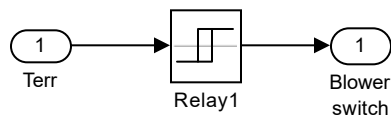
Thermostat Subsystem

3.5.1. Blocks

3.5.1.1. Parameters

3.5.1.1.1. "Blower switch" (Outport)

Table 3.26. "Blower switch" Parameters

Parameter	Value
Port number	1
Icon display	Port number
Minimum	[]
Maximum	[]
Data type	Inherit: auto
Lock output data type setting against changes by the fixed-point tools	off
Output as nonvirtual bus in parent model	off
Unit (e.g., m, m/s^2, N*-m)	inherit
Port dimensions (-1 for inherited)	-1
Variable-size signal	Inherit
Sample time (-1 for inherited)	-1
Ensure outport is virtual	off
Source of initial output value	Dialog
Output when disabled	held
Initial output	0

3.5.1.1.2. "Relay1" (Relay)

Table 3.27. "Relay1" Parameters

Parameter	Value
Switch on point	5*(5/9)
Switch off point	-5*(5/9)
Output when on	1
Output when off	0
Output minimum	[]
Output maximum	[]
Output data type	Inherit: All ports same datatype
Lock output data type setting against changes by the fixed-point tools	off

Parameter	Value
Input processing	Inherited
Enable zero-crossing detection	on
Sample time (-1 for inherited)	-1

3.5.1.1.3. "Terr" (Inport)

Table 3.28. "Terr" Parameters

Parameter	Value
Port number	1
Port dimensions (-1 for inherited)	-1
Sample time (-1 for inherited)	-1
Minimum	[]
Maximum	[]
Data type	Inherit: auto

Chapter 4. System Design Variables

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4.1. Design Variable Summary

Table 4.1. Design Variables

Variable Name	Parent Blocks	Size	Bytes	Class	Value
M	1/Mc [18] 1/Mc [18]	1x1	8	double	1.7784e+03
Mdot	HeatGain [16] HeatGain [16]	1x1	8	double	3600
Req	Heat Losses [18] Heat Losses [18]	1x1	8	double	4.2698e-07
THeater	Heater Air Temperature [14] Heater Air Temperature [14]	1x1	8	double	50
TinIC	Integrator [19] Integrator [19]	1x1	8	double	20
c	HeatGain [16] HeatGain [16] 1/Mc [18] 1/Mc [18]	1x1	8	double	1.0054e+03
cost	Cost Calculator [3] Cost Calculator [3]	1x1	8	double	2.5000e-08

Table 4.2. Functions used in Design Variable Expressions

Function Name	Parent Blocks	Calling string

pi	Daily Temp Variation [4]
	Integrator [19]
	Integrator [19]
	Integrator [4]
	Integrator [4]
		`2*pi/24`
		`pi`
		`-pi`
		`pi`
		`-pi`

4.2. Design Variable Details

M.   1.7784e+03

Used by Blocks:

- sldemo_househeat/House/1//Mc [18]

Resolved in: model workspace (sldemo_househeat)

Mdot.   3600

Used by Blocks:

• sldemo_househeat/Heater/HeatGain [16]

Resolved in: model workspace (sldemo_househeat)

Req.   4.2698e-07

Used by Blocks:

• sldemo_househeat/House/Heat Losses [18]

Resolved in: model workspace (sldemo_househeat)

THeater.   50

Used by Blocks:

• sldemo_househeat/Heater/Heater Air Temperature [14]

Resolved in: model workspace (sldemo_househeat)

TinIC.   20

Used by Blocks:

• sldemo_househeat/House/Integrator [19]

Resolved in: model workspace (sldemo_househeat)

c.   1.0054e+03

Used by Blocks:

• sldemo_househeat/Heater/HeatGain [16]
• sldemo_househeat/House/1//Mc [18]

Resolved in: model workspace (sldemo_househeat)

cost.   2.5000e-08

Used by Blocks:

• sldemo_househeat/Cost Calculator [3]

Resolved in: model workspace (sldemo_househeat)

Chapter 5. Requirements Traceability

sldemo_househeat does not contain requirements traceability links.

Chapter 6. System Model Configuration

Source: Model

Source Name: sldemo_househeat

Table 6.1. sldemo_househeat Configuration Set

Property	Value
Description	
Components	[sldemo_househeat Configuration Set.Components(1) [28], sldemo_househeat Configuration Set.Components(2) [29], sldemo_househeat Configuration Set.Components(3) [30], sldemo_househeat Configuration Set.Components(4) [31], sldemo_househeat Configuration Set.Components(5) [34], sldemo_househeat Configuration Set.Components(6) [35], sldemo_househeat Configuration Set.Components(7) [36], sldemo_househeat Configuration Set.Components(8) [37], sldemo_househeat Configuration Set.Components(9) [38]]
Name	Configuration
SimulationMode	normal
ConfigType	Model

Table 6.2. sldemo_househeat Configuration Set.Components [28](1)

Property	Value
Name	Solver
Description	
Components	
StartTime	0.0
StopTime	48
AbsTol	1e-6
FixedStep	1
InitialStep	auto
MaxNumMinSteps	-1
MaxOrder	5
ZcThreshold	auto
ConsecutiveZCsStepRelTol	10*128*eps
MaxConsecutiveZCs	1000
ExtrapolationOrder	4
NumberNewtonIterations	1
MaxStep	auto

MinStep	auto
MaxConsecutiveMinStep	1
RelTol	1e-3
SolverMode	SingleTasking
EnableMultiTasking	off
EnableConcurrentExecution	off
ConcurrentTasks	off
Solver	ode45
SolverName	ode45
SolverType	Variable-step
SolverJacobianMethodControl	auto
ShapePreserveControl	DisableAll
ZeroCrossControl	UseLocalSettings
ZeroCrossAlgorithm	Nonadaptive
SolverResetMethod	Fast
PositivePriorityOrder	off
AutoInsertRateTranBlk	off
SampleTimeConstraint	Unconstrained
InsertRTBMode	Whenever possible
SampleTimeProperty	

Table 6.3. sldemo_househeat Configuration Set.Components [28](2)

Property	Value
Name	Data Import/Export
Description	
Components	
Decimation	1
ExternalInput	[]
FinalStateName	xFinal
InitialState	[]
LimitDataPoints	off
MaxDataPoints	1000
LoadExternalInput	off
LoadInitialState	off
SaveFinalState	off
SaveCompleteFinalSimState	off
SaveFormat	Array
SaveOutput	off
SaveState	off

SignalLogging	on
DSMLogging	on
InspectSignalLogs	off
VisualizeSimOutput	on
StreamToWorkspace	off
StreamVariableName	streamout
SaveTime	off
ReturnWorkspaceOutputs	off
StateSaveName	xout
TimeSaveName	tout
OutputSaveName	yout
SignalLoggingName	sldemo_househeat_output
DSMLoggingName	dsmout
OutputOption	RefineOutputTimes
OutputTimes	[]
ReturnWorkspaceOutputsName	out
Refine	1
LoggingToFile	off
LoggingFileName	out.mat
LoggingIntervals	[-inf, inf]

Table 6.4. sldemo_househeat Configuration Set.Components [28](3)

Property	Value
Name	Optimization
Description	
Components	
BlockReduction	off
BooleanDataType	off
ConditionallyExecuteInputs	on
DefaultParameterBehavior	Tunable
InlineParams	off
UseDivisionForNetSlopeComputation	off
UseFloatMulNetSlope	off
DefaultUnderspecifiedDataType	double
UseSpecifiedMinMax	off
InlineInvariantSignals	off
OptimizeBlockIOStorage	on
BufferReuse	on
GlobalBufferReuse	on

GlobalVariableUsage	None
StrengthReduction	off
AdvancedOptControl	
EnforceIntegerDowncast	on
ExpressionFolding	on
BooleansAsBitfields	off
BitfieldContainerType	uint_T
EnableMemcpy	on
MemcpyThreshold	64
PassReuseOutputArgsAs	Structure reference
PassReuseOutputArgsThreshold	12
FoldNonRolledExpr	on
LocalBlockOutputs	on
RollThreshold	5
StateBitsets	off
DataBitsets	off
ActiveStateOutputEnumStorageType	Native Integer
UseTempVars	off
ZeroExternalMemoryAtStartup	on
ZeroInternalMemoryAtStartup	on
InitFltsAndDblsToZero	on
NoFixptDivByZeroProtection	off
EfficientFloat2IntCast	off
EfficientMapNaN2IntZero	on
LifeSpan	inf
EvaledLifeSpan	Inf
MaxStackSize	Inherit from target
BufferReusableBoundary	off
SimCompilerOptimization	off
AccelVerboseBuild	off

Table 6.5. sldemo_househeat Configuration Set.Components [28](4)

Property	Value
Name	Diagnostics
Description	
Components	
RTPrefix	error
ConsistencyChecking	none
ArrayBoundsChecking	none

SignalInfNanChecking	none
SignalRangeChecking	none
ReadBeforeWriteMsg	UseLocalSettings
WriteAfterWriteMsg	UseLocalSettings
WriteAfterReadMsg	UseLocalSettings
AlgebraicLoopMsg	warning
ArtificialAlgebraicLoopMsg	warning
SaveWithDisabledLinksMsg	warning
SaveWithParameterizedLinksMsg	none
CheckSSInitialOutputMsg	on
UnderspecifiedInitializationDetection	Classic
MergeDetectMultiDrivingBlocksExec	none
CheckExecutionContextRuntimeOutputMsg	off
SignalResolutionControl	TryResolveAllWithWarning
BlockPriorityViolationMsg	warning
MinStepSizeMsg	warning
TimeAdjustmentMsg	none
MaxConsecutiveZCsMsg	error
MaskedZcDiagnostic	warning
IgnoredZcDiagnostic	warning
SolverPrmCheckMsg	none
InheritedTsInSrcMsg	warning
MultiTaskDSMMsg	warning
MultiTaskCondExecSysMsg	none
MultiTaskRateTransMsg	error
SingleTaskRateTransMsg	none
TasksWithSamePriorityMsg	warning
SigSpecEnsureSampleTimeMsg	warning
CheckMatrixSingularityMsg	none
IntegerOverflowMsg	none
Int32ToFloatConvMsg	warning
ParameterDowncastMsg	error
ParameterOverflowMsg	error
ParameterUnderflowMsg	none
ParameterPrecisionLossMsg	warning
ParameterTunabilityLossMsg	warning
FixptConstUnderflowMsg	none
FixptConstOverflowMsg	none
FixptConstPrecisionLossMsg	none

UnderSpecifiedDataTypeMsg	none
UnnecessaryDatatypeConvMsg	none
VectorMatrixConversionMsg	none
InvalidFcnCallConnMsg	error
FcnCallInpInsideContextMsg	warning
SignalLabelMismatchMsg	none
UnconnectedInputMsg	warning
UnconnectedOutputMsg	warning
UnconnectedLineMsg	warning
UseOnlyExistingSharedCode	error
SFcnCompatibilityMsg	none
FrameProcessingCompatibilityMsg	error
UniqueDataStoreMsg	none
BusObjectLabelMismatch	none
RootOutportRequireBusObject	warning
AssertControl	UseLocalSettings
Echo	
EnableOverflowDetection	off
AllowSymbolicDim	on
ModelReferenceIOMsg	none
ModelReferenceVersionMismatchMessage	none
ModelReferenceIOMismatchMessage	none
ModelReferenceCSMismatchMessage	none
ModelReferenceSimTargetVerbose	off
UnknownTsInhSupMsg	warning
ModelReferenceDataLoggingMessage	warning
ModelReferenceSymbolNameMessage	warning
ModelReferenceExtraNoncontSigs	error
StateNameClashWarn	warning
SimStateInterfaceChecksumMismatchMsg	warning
SimStateOlderReleaseMsg	error
InitInArrayFormatMsg	warning
StrictBusMsg	ErrorLevel1
BusNameAdapt	WarnAndRepair
NonBusSignalsTreatedAsBus	none
SFUnusedDataAndEventsDiag	warning
SFUnexpectedBacktrackingDiag	warning
SFInvalidInputDataAccessInChartInitDiag	warning
SFNoUnconditionalDefaultTransitionDiag	warning

SFTransitionOutsideNaturalParentDiag	warning
SFUnconditionalTransitionShadowingDiag	warning
SFUnreachableExecutionPathDiag	warning
SFUndirectedBroadcastEventsDiag	warning
SFTransitionActionBeforeConditionDiag	warning
SFOutputUsedAsStateInMooreChartDiag	error
SFTemporalDelaySmallerThanSampleTimeDiag	warning
SFUnconditionalPathOutOfParentDiag	warning
SFSelfTransitionDiag	warning
SFExecutionAtInitializationDiag	none
SFMachineParentedDataDiag	warning
SFUnreachableStateOrJunctionDiag	warning
SFDanglingTransitionDiag	warning
IntegerSaturationMsg	none
AllowedUnitSystems	all
UnitsInconsistencyMsg	warning
AllowAutomaticUnitConversions	on

Table 6.6. sldemo_househeat Configuration Set.Components [28](5)

Property	Value
Name	Hardware Implementation
Description	
Components	
ProdBitPerChar	8
ProdBitPerShort	16
ProdBitPerInt	32
ProdBitPerLong	32
ProdBitPerLongLong	64
ProdBitPerFloat	32
ProdBitPerDouble	64
ProdBitPerPointer	32
ProdBitPerSizeT	32
ProdBitPerPtrDiffT	32
ProdLargestAtomicInteger	Char
ProdLargestAtomicFloat	None
ProdIntDivRoundTo	Undefined
ProdEndianess	Unspecified
ProdWordSize	32

ProdShiftRightIntArith	on
ProdLongLongMode	off
ProdHWDeviceType	32-bit Generic
TargetBitPerChar	8
TargetBitPerShort	16
TargetBitPerInt	32
TargetBitPerLong	32
TargetBitPerLongLong	64
TargetBitPerFloat	32
TargetBitPerDouble	64
TargetBitPerPointer	32
TargetBitPerSizeT	32
TargetBitPerPtrDiffT	32
TargetLargestAtomicInteger	Char
TargetLargestAtomicFloat	None
TargetShiftRightIntArith	on
TargetLongLongMode	off
TargetIntDivRoundTo	Undefined
TargetEndianess	Unspecified
TargetWordSize	32
TargetTypeEmulationWarnSuppressLevel	0
TargetPreprocMaxBitsSint	32
TargetPreprocMaxBitsUint	32
TargetHWDeviceType	Specified
TargetUnknown	on
ProdEqTarget	on
UseEmbeddedCoderFeatures	on
UseSimulinkCoderFeatures	on

Table 6.7. sldemo_househeat Configuration Set.Components [28](6)

Property	Value
Name	Model Referencing
Description	
Components	
UpdateModelReferenceTargets	IfOutOfDateOrStructuralChange
SkipRefExpFcnMdlSchedulingOrderCheck	off
EnableRefExpFcnMdlSchedulingChecks	on
CheckModelReferenceTargetMessage	error

EnableParallelModelReferenceBuilds	off
ParallelModelReferenceErrorOnInvalidPool	on
ParallelModelReferenceMATLABWorkerInit	None
ModelReferenceNumInstancesAllowed	Multi
PropagateVarSize	Infer from blocks in model
ModelDependencies	
ModelReferencePassRootInputsByReference	on
ModelReferenceMinAlgLoopOccurrences	off
PropagateSignalLabelsOutOfModel	off
SupportModelReferenceSimTargetCustomCode	off

Table 6.8. sldemo_househeat Configuration Set.Components [28](7)

Property	Value
Name	Simulation Target
Description	
Components	
SimCustomSourceCode	
SimCustomHeaderCode	
SimCustomInitializer	
SimCustomTerminator	
SimReservedNameArray	
SimUserSources	
SimUserIncludeDirs	
SimUserLibraries	
SimUserDefines	
SFSimEnableDebug	off
SFSimOverflowDetection	on
SFSimEcho	on
SimBlas	on
SimCtrlC	on
SimExtrinsic	on
SimIntegrity	on
SimUseLocalCustomCode	off
SimParseCustomCode	on
SimBuildMode	sf_incremental_build
SimDataInitializer	
SimGenImportedTypeDefs	off
CompileTimeRecursionLimit	50

EnableRuntimeRecursion	on

Table 6.9. sldemo_househeat Configuration Set.Components [28](8)

Property	Value
Name	Code Generation
SystemTargetFile	grt.tlc
HardwareBoard	None
TLCOptions	
CodeGenDirectory	
GenCodeOnly	off
MakeCommand	make_rtw
GenerateMakefile	on
PackageGeneratedCodeAndArtifacts	off
PackageName	
TemplateMakefile	grt_default_tmf
PostCodeGenCommand	
Description	Generic Real-Time Target
GenerateReport	off
SaveLog	off
RTWVerbose	on
RetainRTWFile	off
ProfileTLC	off
TLCDebug	off
TLCCoverage	off
TLCAssert	off
ProcessScriptMode	Default
ConfigurationMode	Optimized
ProcessScript	
ConfigurationScript	
ConfigAtBuild	off
RTWUseLocalCustomCode	off
RTWUseSimCustomCode	off
CustomSourceCode	
CustomHeaderCode	
CustomInclude	
CustomSource	
CustomLibrary	
CustomDefine	

CustomLAPACKCallback	
CustomInitializer	
CustomTerminator	
Toolchain	Automatically locate an installed toolchain
BuildConfiguration	Faster Builds
CustomToolchainOptions	
IncludeHyperlinkInReport	off
LaunchReport	off
RecursionLimit	50
PortableWordSizes	off
GenerateErtSFunction	off
CreateSILPILBlock	None
CodeExecutionProfiling	off
CodeExecutionProfileVariable	executionProfile
CodeProfilingSaveOptions	SummaryOnly
CodeProfilingInstrumentation	off
CodeCoverageSettings	sldemo_househeat Configuration Set.Components-(8).CodeCoverageSettings [40]
SILDebugging	off
TargetLang	C
IncludeERTFirstTime	off
GenerateTraceInfo	off
GenerateTraceReport	off
GenerateTraceReportSl	off
GenerateTraceReportSf	off
GenerateTraceReportEml	off
GenerateCodeInfo	off
GenerateWebview	off
GenerateCodeMetricsReport	off
GenerateCodeReplacementReport	off
RTWCompilerOptimization	off
ObjectivePriorities	
RTWCustomCompilerOptimizations	
CheckMdlBeforeBuild	Off
CustomRebuildMode	OnUpdate
DataInitializer	
Components	[sldemo_househeat Configuration Set.Components(8).Components(1) [40], sldemo_househeat Configuration Set.Components(8).Components(2)-[41]]

Table 6.10. sldemo_househeat Configuration Set.Components [28](9)

Property	Value
Description	Simulink Coverage Configuration Component
Components	
Name	Simulink Coverage
CovEnable	off
CovScope	EntireSystem
CovIncludeTopModel	on
RecordCoverage	off
CovPath	/
CovSaveName	covdata
CovCompData	
CovMetricSettings	dw
CovFilter	
CovHTMLOptions	
CovNameIncrementing	off
CovHtmlReporting	on
CovForceBlockReductionOff	on
CovEnableCumulative	on
CovSaveCumulativeToWorkspaceVar	on
CovSaveSingleToWorkspaceVar	on
CovCumulativeVarName	covCumulativeData
CovCumulativeReport	off
CovSaveOutputData	on
CovOutputDir	slcov_output/$ModelName$
CovDataFileName	$ModelName$_cvdata
CovShowResultsExplorer	on
CovReportOnPause	on
CovModelRefEnable	off
CovModelRefExcluded	
CovExternalEMLEnable	off
CovSFcnEnable	on
CovBoundaryAbsTol	1.0000e-05
CovBoundaryRelTol	0.0100
CovUseTimeInterval	off
CovStartTime	0
CovStopTime	0
CovMetricStructuralLevel	Decision
CovMetricLookupTable	off

CovMetricSignalRange	off
CovMetricSignalSize	off
CovMetricObjectiveConstraint	off
CovMetricSaturateOnIntegerOverflow	off
CovMetricRelationalBoundary	off
CovLogicBlockShortCircuit	off
CovUnsupportedBlockWarning	on
CovHighlightResults	on

Table 6.11. sldemo_househeat Configuration Set.Components(8) [37].CodeCoverageSettings

Property	Value
TopModelCoverage	off
ReferencedModelCoverage	off
CoverageTool	None

Table 6.12. sldemo_househeat Configuration Set.Components(8).Components [38](1)

Property	Value
Name	Code Appearance
Description	
Components	
ForceParamTrailComments	off
GenerateComments	on
CommentStyle	Auto
IgnoreCustomStorageClasses	on
IgnoreTestpoints	off
IncHierarchyInIds	off
MaxIdLength	31
PreserveName	off
PreserveNameWithParent	off
ShowEliminatedStatement	off
OperatorAnnotations	off
IncAutoGenComments	off
SimulinkDataObjDesc	off
SFDataObjDesc	off
MATLABFcnDesc	off
IncDataTypeInIds	off
PrefixModelToSubsysFcnNames	on

MangleLength	1
CustomSymbolStr	RN$M
CustomSymbolStrGlobalVar	RN$M
CustomSymbolStrType	NR$M_T
CustomSymbolStrField	NM
CustomSymbolStrFcn	RNMF
CustomSymbolStrSimulinkFcn	RN
CustomSymbolStrFcnArg	rt$I$N$M
CustomSymbolStrBlkIO	rtb_NM
CustomSymbolStrTmpVar	NM
CustomSymbolStrMacro	RN$M
CustomSymbolStrUtil	NC
CustomUserTokenString	
CustomCommentsFcn	
DefineNamingRule	None
DefineNamingFcn	
ParamNamingRule	None
ParamNamingFcn	
SignalNamingRule	None
SignalNamingFcn	
InsertBlockDesc	off
InsertPolySpaceComments	off
SimulinkBlockComments	on
MATLABSourceComments	off
EnableCustomComments	off
InternalIdentifier	Shortened
InlinedPrmAccess	Literals
ReqsInCode	off
UseSimReservedNames	off
ReservedNameArray	

Table 6.13. sldemo_househeat Configuration Set.Components(8).Components [38](2)

Property	Value
Name	Target
Description	
Components	
IsERTTarget	off
TargetFcnLib	ansi_tfl_tmw.mat

TargetLibSuffix	
TargetPreCompLibLocation	
GenFloatMathFcnCalls	NOT IN USE
TargetLangStandard	C89/C90 (ANSI)
TargetFunctionLibrary	NOT IN USE
CodeReplacementLibrary	None
UtilityFuncGeneration	Auto
ERTMultiwordTypeDef	System defined
ERTMultiwordLength	256
MultiwordLength	2048
GenerateFullHeader	on
InferredTypesCompatibility	off
ExistingSharedCode	
GenerateSampleERTMain	off
GenerateTestInterfaces	off
ModelReferenceCompliant	on
ParMdlRefBuildCompliant	on
CompOptLevelCompliant	on
ConcurrentExecutionCompliant	on
IncludeMdlTerminateFcn	on
CombineOutputUpdateFcns	off
CombineSignalStateStructs	off
SuppressErrorStatus	off
ERTFirstTimeCompliant	off
IncludeFileDelimiter	Auto
ERTCustomFileBanners	off
SupportAbsoluteTime	on
LogVarNameModifier	rt_
MatFileLogging	on
MultiInstanceERTCode	off
CodeInterfacePackaging	Nonreusable function
SupportNonFinite	on
SupportComplex	on
PurelyIntegerCode	off
SupportContinuousTime	on
SupportNonInlinedSFcns	on
RemoveDisableFunc	off
RemoveResetFunc	off
SupportVariableSizeSignals	off

ParenthesesLevel	Nominal
CastingMode	Nominal
GenerateClassInterface	off
ModelStepFunctionPrototypeControlCompliant	off
CPPClassGenCompliant	on
GRTInterface	on
GenerateAllocFcn	off
UseToolchainInfoCompliant	on
GenerateSharedConstants	on
ExtMode	off
ExtModeStaticAlloc	off
ExtModeTesting	off
ExtModeStaticAllocSize	1000000
ExtModeTransport	0
ExtModeMexFile	ext_comm
ExtModeMexArgs	
ExtModeIntrfLevel	Level1
RTWCAPISignals	off
RTWCAPIParams	off
RTWCAPIStates	off
RTWCAPIRootIO	off
GenerateASAP2	off
MultiInstanceErrorCode	Error

Chapter 7. Glossary

Atomic Subsystem.   A subsystem treated as a unit by an implementation of the design documented in this report. The implementation computes the outputs of all the blocks in the atomic subsystem before computing the next block in the parent system's block execution order (sorted list).

Block Diagram.   A Simulink block diagram represents a set of simultaneous equations that relate a system or subsystem's inputs to its outputs as a function of time. Each block in the diagram represents an equation of the form $y = f(t, x, u)$ where t is the current time, u is a block input, y is a block output, and x is a system state (see the Simulink documentation for information on the functions represented by the various types of blocks that make up the diagram). Lines connecting the blocks represent dependencies among the blocks, i.e., inputs whose current values are the outputs of other blocks. An implementation of a design described in this document computes a root or atomic system's outputs at each time step by computing the outputs of the blocks in an order determined by block input/output dependencies.

Block Parameter.   A variable that determines the output of a block along with its inputs, for example, the gain parameter of a Gain block.

Block Execution Order.   The order in which Simulink evaluates blocks during simulation of a model. The block execution order determined by Simulink ensures that a block executes only after all blocks on whose outputs it depends are executed.

Checksum.   A number that indicates whether different versions of a model or atomic subsystem differ functionally or only cosmetically. Different checksums for different versions of the same model or subsystem indicate that the versions differ functionally.

Design Variable.   A symbolic (MATLAB) variable or expression used as the value of a block parameter. Design variables allow the behavior of the model to be altered by altering the value of the design variable.

Signal.   A block output, so-called because block outputs typically vary with time.

Virtual Subsystem.   A subsystem that is purely graphical, i.e., is intended to reduce the visual complexity of the block diagram of which it is a subsystem. An implementation of the design treats the blocks in the subsystem as part of the first nonvirtual ancestor of the virtual subsystem (see Atomic Subsystem).

Chapter 8. About this Report

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8.1. Report Overview

This report describes the design of the sldemo_househeat system. The report was generated automatically from a Simulink model used to validate the design. It contains the following sections:

Model Version.   Specifies information about the version of the model from which this design description was generated. Includes the model checksum, a number that indicates whether different versions of the model differ functionally or only cosmetically. Different checksums for different versions indicate that the versions differ functionally.

Root System.   Describes the design's root system.

Subsystems.   Describes each of the design's subsystems.

Design Variables.   Describes system design variables, i.e., MATLAB variables and expressions used as block parameter values.

System Model Configuration.   Lists the configuration parameters, e.g., start and stop time, of the model used to simulate the system described by this report.

Requirements Traceability.   Shows design requirements associated with elements of the design model. This section appears only if the design model contains requirements links.

Glossary.   Defines Simulink terms used in this report.

8.2. Root System Description

This section describes a design's root system. It contains the following sections:

Diagram.   Simulink block diagram that represents the algorithm used to compute the root system's outputs.

Description.   Description of the root system. This section appears only if the model's root system has a Documentation property or a Doc block.

Interface.   Name, data type, width, and other properties of the root system's input and output signals. The number of the block port that outputs the signal appears in angle brackets appended to the signal name. This section appears only if the root system has input or output ports.

Blocks.   This section has two subsections:

• **Parameters.**   Describes key parameters of blocks in the root system. This section also includes graphical and/or tabular representations of lookup table data used by lookup table blocks, i.e., blocks that use lookup tables to compute their outputs.

- **Block Execution Order.**　Order in which blocks must be executed at each time step in order to ensure that each block's inputs are available when it executes.

State Charts.　Describes state charts used in the root system. This section appears only if the root system contains Stateflow blocks.

8.3. Subsystem Descriptions

This section describes a design's subsystems. Each subsystem description contains the following sections:

Checksum.　This section appears only if the subsystem is an atomic subsystem. The checksum indicates whether the version of the model subsystem used to generate this report differs functionally from other versions of the model subsystem. If two model checksums differ, the corresponding versions of the model differ functionally.

Diagram.　Simulink block diagram that graphically represents the algorithm used to compute the subsystem's outputs.

Description.　Description of the subsystem. This section appears only if the subsystem has a Documentation property or contains a Doc block.

Interface.　Name, data type, width, and other properties of the subsystem's input and output signals. The number of the block port that outputs the signal appears in angle brackets appended to the signal name. This section appears only if the subsystem is atomic and has input or output ports.

Blocks.　Blocks that this subsystem contains. This section has two subsections:

- **Parameters.**　Key parameters of blocks in the subsystem. This section also includes graphical and/or tabular representations of lookup table data used by lookup table blocks, blocks that use lookup tables to compute their outputs.
- **Block Execution Order.**　Order in which the subsystem's blocks must be executed at each time step in order to ensure that each block's inputs are available when the block executes .This section appears only if the subsystem is atomic. Note: in Acrobat(PDF) reports, the number in square brackets next to the block name is a hyperlink to the block parameter table. The number has no model significance.

State Charts.　Describes state charts used in the subsystem. This section appears only if the root system contains Stateflow blocks.

8.4. State Chart Descriptions

This section describes the state machines used by Stateflow blocks to compute their outputs, i.e., Stateflow blocks. Each state machine description contains the following sections:

Chart.　Diagram representing the state machine.

States.　Describes the state machine's states. Each state description includes the state's diagram and diagrams and/or descriptions of graphical functions, Simulink functions, truth tables, and MATLAB functions parented by the state.

Transitions.　Transitions between the state machine's states. Each transition description specifies the values of key transition properties. Appears only if a transition has properties that do not appear on the chart.

Junctions.　Transition junctions. Each junction description specifies the values of key junction properties. Appears only if a junction has properties that do not appear on the chart.

Events.   Events that trigger state transitions. Each event description specifies the values of key event properties.

Data.   Data types and other properties of the Stateflow block's inputs, outputs, and other state machine data.

Targets.   Executable implementations of the state machine used to compute the outputs of the corresponding Stateflow block.

MATLAB Supporting Functions.   List of functions invoked by MATLAB functions defined in the chart.