

Steffen Bangsow

# Tecnomatix Plant Simulation

Modeling  
and  
Programming  
by Means  
of Examples



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# Preface

Based on the competition of international production networks, the pressure to increase the efficiency of production systems has increased significantly. In addition, the number of technical components in many products and as a consequence also the requirements for corresponding assembly processes and logistics processes increases. International logistics networks require corresponding logistics concepts.

These requirements can be managed only by using appropriate Digital Factory tools in the context of a product lifecycle management environment, which allows reusing data, supports an effective cooperation between different departments, and provides up-to-date and relevant data to every user who needs it.

Simulating the complete material flow including all relevant production, storage, and transport activities is recognized as a key component of the Digital Factory in the industry and as of today widely used and accepted. Cutting inventory and throughput time by 20–60% and enhancing the productivity of existing production facilities by 15–20% can be achieved in real-life projects.

The purpose of running simulations varies from strategic to tactical up to operational goals. From a strategic point of view, users answer questions like which factory in which country suits best to produce the next generation product taking into account factors like consequences for logistics, worker efficiency, downtimes, flexibility, storage costs, etc., looking at production strategies for the next years. In this context, users also evaluate the flexibility of the production system, e.g., for significant changes of production numbers — a topic which becomes more and more important. On a tactical level, simulation is executed for a time frame of 1–3 months in average to analyze required resources, optimize the sequence of orders, and lot sizes. For simulation on an operational level, data are imported about the current status of production equipment and the status of work in progress to execute a forward simulation till the end of the current shift. In this case, the purpose is to check if the target output for the shift will be reached and to evaluate emergency strategies in case of disruptions or capacities being not available unexpectedly.

In any case, users run simulation to take a decision about a new production system or evaluate an existing production system. Usually, the value of those systems is a significant factor for the company, so the users have to be sure that they take the right decision based on accurate numbers. There are several random processes in real production systems like technical availabilities, arrival times of assembly parts, process times of human activities, etc., so stochastic processes play an important role for throughput simulation. Therefore, Plant Simulation provides a whole range of

easy-to-use tools to analyze models with stochastic processes, to calculate distributions for sample values, to manage simulation experiments, and to determine optimized system parameters.

Besides that, results of a simulation model depend on the quality of the input data and the accuracy of the model compared to the behavior of the real production system. As soon as assembly processes are involved, several transport systems with their transport controls, workers with multiple qualification profiles or storage logic, production processes become highly complex. Plant Simulation provides all necessary functionality to model, analyze, and maintain large and complex systems in an efficient way. Key features like object orientation and inheritance allow users to develop, exchange/reuse, and maintain their own objects and libraries to increase modeling efficiency. The unique Plant Simulation optimization capabilities support users to optimize multiple system parameters at once like the number of transporters, monorail carriers, buffer/storage capacities, etc., taking into account multiple evaluation criteria like reduced stock, increased utilization, increased throughput, etc.

Based on these accurate modeling capabilities and statistic analysis capabilities, typically an accuracy of at least 99% of the throughput values is achieved with Plant Simulation models in real-life projects depending on the level of detail. Based on the price of production equipment, a return on investment of the costs to introduce simulation is quite often already achieved after the first simulation project.

Visualizing the complete model in the Plant Simulation 3D environment allows an impressive 3D presentation of the system behavior. Logfiles can be used to visualize the simulation in a Virtual Reality (VR) environment. The support of a Siemens PLM Software unified 3D graphics engine and unified graphics format allows a common look-and-feel and easy access to 3D graphics which were created in other tools like digital product design or 3D factory layout design tools.

The modeling of complex logic always requires the usage of a programming language. Plant Simulation simplifies the need to work with programming language tremendously by supporting the user with templates, with an extensive examples collection and a professional debugging environment.

Compared to other simulation tools in the market, Plant Simulation supports a very flexible way of working with the model, e.g., by changing system parameters while the simulation is running.

This book provides the first comprehensive introduction to Plant Simulation. It supports new users of the software to get started quickly, provides an excellent introduction how to work with the embedded programming language SimTalk, and even helps advanced users with examples of typical modeling tasks. The book focuses on the basic knowledge required to execute simulation projects with Plant Simulation, which is an excellent starting point for real-life projects.

We wish you a lot of success with Tecnomatix Plant Simulation.

November 2009

Dirk Molfenter †  
*Siemens PLM Software*

# Contents

<b>1</b>	<b>Basics .....</b>	<b>1</b>
1.1	Introducing Material Flow and Logistics Simulation.....	1
1.1.1	Uses .....	1
1.1.2	Definitions .....	2
1.1.3	Procedure of Simulation .....	2
1.1.3.1	Formulation of Problems.....	3
1.1.3.2	Test of Simulation-Worthiness.....	3
1.1.3.3	Formulation of Targets.....	3
1.1.3.4	Data Collection.....	3
1.1.3.5	Modeling .....	4
1.1.3.6	Executing Simulation Runs.....	5
1.1.3.7	Result Analysis and Result Interpretation .....	5
1.1.3.8	Documentation .....	6
1.2	Plant Simulation: First Steps .....	6
1.2.1	The Tutorial.....	6
1.2.2	Step-by-Step Help .....	6
1.2.3	Example Collections and Demo Videos.....	7
1.2.4	The Siemens PLM Software Community.....	7
1.3	Introductory Example.....	8
1.4	First Simulation Example.....	9
1.4.1	Insert Objects into the Frame .....	9
1.4.2	Connect the Objects .....	10
1.4.3	Define the Settings of the Objects.....	10
1.4.4	Run the Simulation .....	11
1.5	Modeling .....	11
1.5.1	Object-Related Modeling .....	11
1.5.2	Object-Oriented Modeling .....	12
1.6	Student and Demo Version .....	14
<b>2</b>	<b>SimTalk and Dialogs .....</b>	<b>17</b>
2.1	The Object Method .....	17
2.2	The Method Editor.....	19
2.2.1	Line Numbers, Entering Text.....	19
2.2.2	Bookmarks .....	19



2.2.3	Code Completion.....	20
2.2.4	Information about Attributes and Methods .....	20
2.2.5	Templates .....	22
2.2.6	The Debugger.....	22
2.3	SimTalk.....	23
2.3.1	Names.....	23
2.3.2	Anonymous Identifiers .....	24
2.3.3	Paths .....	25
2.3.3.1	Absolute Path .....	25
2.3.3.2	Relative Path .....	25
2.3.3.3	Name Scope .....	25
2.3.4	Comments .....	26
2.4	Variables and Data Types .....	27
2.4.1	Variables .....	27
2.4.2	Local Variables .....	27
2.4.3	Arrays.....	29
2.4.4	Global Variables.....	30
2.5	Operators.....	32
2.5.1	Mathematical Operators .....	32
2.5.2	Logical (Relational) Operators.....	33
2.5.3	Assignments .....	33
2.6	Branching .....	35
2.7	Case Differentiation .....	37
2.8	Loops.....	38
2.8.1	Conditional Loops .....	38
2.8.1.1	Header-Controlled Loops.....	38
2.8.1.2	Footer-Controlled Loops .....	39
2.8.2	For Loop.....	39
2.9	Methods and Functions .....	41
2.9.1	Passing Arguments.....	41
2.9.2	Passing Several Arguments at the Same Time .....	42
2.9.3	Result of a Function .....	43
2.9.4	Predefined SimTalk Functions .....	45
2.9.5	Method Call.....	47
2.9.5.1	Sensors .....	47
2.9.5.2	Other Events for Calling Methods.....	50
2.9.5.3	Constructors and Destructors .....	52
2.9.5.4	Drag and Drop Control.....	53
2.9.5.5	Method Call after a Certain Timeout .....	53
2.9.5.6	Recursive Programming.....	55
2.9.5.7	Observer .....	57
2.10	Interrupt Methods.....	58
2.10.1	The Wait Statement.....	58
2.10.2	Suspending of Methods.....	58

2.11	Debugging, Optimization .....	61
2.11.1	Breakpoints in Methods .....	61
2.11.2	Breakpoints in the EventController .....	64
2.11.3	Error Handler .....	64
2.11.4	Profiler .....	66
2.12	Hierarchical Modeling .....	69
2.12.1	The Frame .....	69
2.12.2	The Interface .....	69
2.12.3	Create Your Own Libraries .....	72
2.13	Dynamic Model Generation .....	73
2.13.1	Required Data, SimTalk Language Elements .....	73
2.13.2	Create Objects and Set Attributes .....	74
2.13.3	Link Objects Dynamically with Connectors .....	76
2.13.4	Connect Objects Dynamically with Lines .....	77
2.14	Dialogs .....	79
2.14.1	Elements of the Dialog .....	79
2.14.1.1	The Dialog Object .....	80
2.14.1.2	Callback Function .....	82
2.14.1.3	The Static Text Box .....	83
2.14.1.4	The Edit Text Box .....	83
2.14.1.5	Images in Dialogs .....	84
2.14.1.6	Buttons .....	85
2.14.1.7	Radio Buttons .....	87
2.14.1.8	Checkbox .....	88
2.14.1.9	Drop-Down List Box and List Box .....	89
2.14.1.10	List View .....	90
2.14.1.11	Tab Control .....	93
2.14.1.12	Group Box .....	93
2.14.1.13	Menu and Menu Item .....	93
2.14.2	Accessing Dialogs .....	94
2.14.3	User Interface Controls .....	95
2.14.4	Input Functions .....	96
2.14.5	Output Functions .....	98
2.14.5.1	MessageBox .....	98
2.14.5.2	Infobox .....	100
2.14.5.3	Bell and Beep .....	100
2.14.5.4	HTML Window .....	100
<b>3</b>	<b>Modeling of Production Processes .....</b>	<b>103</b>
3.1	Material Flow Library Elements .....	103
3.1.1	General Behavior of the Material Flow Elements .....	103
3.1.1.1	Time Consumption .....	104
3.1.1.2	Capacity .....	106

3.1.1.3	Blocking, Exit Behavior.....	106
3.1.1.4	Failures.....	108
3.1.2	ShiftCalendar.....	111
3.2	SimTalk Attributes and Methods of the Material Flow Elements ...	118
3.2.1	States of the Material Flow Elements.....	118
3.2.2	Setup.....	126
3.2.3	Finished Messages.....	128
3.2.3.1	Finished Messages Using resWorking .....	128
3.2.3.2	Create Your Own Finished Messages .....	129
3.2.4	Content of the Material Flow Objects .....	132
3.3	Mobile Units (MUs).....	132
3.3.1	Standard Methods of Mobile Units .....	132
3.3.2	Length, Width and Booking Point.....	134
3.3.3	Entity and Container.....	136
3.4	Source and Drain.....	138
3.4.1	Basic Behavior of the Source .....	138
3.4.2	Settings of the Source.....	139
3.4.3	Source Control Using a Trigger .....	143
3.4.4	User-defined Source with SimTalk .....	146
3.4.5	The Drain .....	148
3.5	Single Processing .....	148
3.5.1	SingleProc, Fixed Chained Machines.....	149
3.5.2	Batch Processing .....	149
3.6	Simultaneous Processing of Several Parts.....	154
3.6.1	The ParallelProc .....	154
3.6.2	Machine with Parallel Processing Stations.....	157
3.6.3	Continuous Machining, Fixed Transfer Lines .....	159
3.6.4	The Cycle, Flexible Cycle Lines .....	160
3.7	Assembly Processes .....	162
3.7.1	The AssemblyStation .....	162
3.7.2	Assembly with Variable Assembly Tables.....	164
3.7.3	Use SimTalk to Model Assembly Processes .....	166
3.8	Dismantling .....	169
3.8.1	The DismantleStation.....	169
3.8.2	Simulation of Split-Up Processes.....	173
3.8.3	Dismantle Processes Using SimTalk.....	174
3.9	Scrap and Rework .....	176
3.9.1	The FlowControl .....	176
3.9.2	Model Scrap Using the Exit Strategy .....	178
<b>4</b>	<b>Information Flow, Controls.....</b>	<b>181</b>
4.1	The List Editor .....	181
4.2	One-Dimensional Lists.....	182

4.2.1	The CardFile.....	182
4.2.2	StackFile and QueueFile .....	183
4.2.3	Searching in Lists .....	184
4.3	The TableFile .....	184
4.3.1	Methods and Attributes of the TableFile.....	185
4.3.2	Searching in TableFiles .....	186
4.3.3	Calculating within Tables.....	190
4.3.4	Nested Tables and Nested Lists.....	191
4.4	TimeSequence .....	193
4.4.1	The Object TimeSequence .....	193
4.4.2	TimeSequence with TableFile and SimTalk .....	196
4.5	The Trigger .....	197
4.5.1	The Object Trigger .....	197
4.5.2	Trigger with SimTalk and TableFile .....	200
4.6	The Generator .....	206
4.6.1	The Generator Object.....	206
4.6.2	User-defined Generator with SimTalk .....	207
4.7	The AttributeExplorer .....	209
4.8	The EventController.....	211
4.9	Shop Floor Control, Push Control.....	216
4.9.1	Base Model Machine.....	217
4.9.2	Elements of the Job Shop Simulation.....	218
4.9.2.1	Work Plans .....	219
4.9.2.2	Order Management.....	221
4.9.2.3	Resource Management .....	224
4.9.2.4	Production Control .....	225
4.10	Pull Control .....	227
4.10.1	Simple Pull Control.....	227
4.10.2	Kanban .....	228
4.10.2.1	Functioning of the Kanban System .....	228
4.10.2.2	Control Loops .....	229
4.10.2.3	Modeling of a Single-Stage E-Kanban System ....	229
4.10.2.4	Bin Kanban System.....	239
4.10.2.5	Card Kanban System.....	243
4.10.3	The Plant Simulation Kanban Library.....	243
4.11	Line Production.....	246
4.11.1	CONWIP Control .....	246
4.11.2	Overall System Availability, Line Down Time.....	249
4.11.3	Sequence Stability .....	253
<b>5</b>	<b>Working with Random Values.....</b>	<b>261</b>
5.1	Working with Distribution Tables.....	261
5.2	Working with Probability Distributions .....	267
5.2.1	Use of DataFit to Determine Probability Distributions .....	267

5.2.2	Use of Uniform Distributions .....	270
5.2.3	Set of Random Distributed Values Using SimTalk .....	270
5.3	Warm-Up Time .....	271
5.4	The ExperimentManager .....	272
5.4.1	Simple Experiments .....	273
5.4.2	Multi-level Experimental Design .....	275
5.5	Generic Algorithms .....	277
5.5.1	GA Sequence Tasks .....	277
5.5.2	GA Range Allocation .....	279
<b>6</b>	<b>Simulation of Transport Processes .....</b>	<b>283</b>
6.1	The Line .....	283
6.1.1	Attributes of the Line .....	283
6.1.2	Curves and Corners .....	285
6.2	AngularConverter and Turntable .....	286
6.2.1	Settings of the AngularConverter .....	288
6.2.2	Settings of the Turntable .....	288
6.2.3	Turntable, Select User-defined Exit .....	289
6.3	The Turnplate .....	290
6.3.1	Basic Behavior of the Turnplate .....	290
6.3.2	Settings of the Turnplate .....	290
6.4	The Converter .....	292
6.5	The Track .....	295
6.6	Sensors on Length-Oriented Blocks .....	296
6.6.1	Function and Use of Sensors .....	296
6.6.2	Light Barrier Mode .....	299
6.6.3	Create Sensors Automatically .....	301
6.7	The Transporter .....	303
6.7.1	Attributes of the Transporter .....	303
6.7.2	Load and Unload the Transporter Using the AssemblyStation and the DismantlingStation .....	305
6.7.3	Load and Unload the Transporter Using the TransferStation .....	307
6.7.4	Load and Unload Transporter Using SimTalk .....	309
6.7.5	SimTalk Methods and Attributes of the Transporter .....	309
6.7.6	Stopping and Continuing .....	310
6.7.7	Drive a Certain Distance .....	314
6.7.8	Routing .....	319
6.7.8.1	Automatic Routing .....	319
6.7.8.2	Routing (Destination Lists) .....	321
6.7.8.3	Routing with SimTalk .....	324
6.7.8.4	Driving Control ("freestyle") .....	325
6.7.9	Sensorposition, Sensor-ID, Direction .....	328
6.7.10	Start Delay Duration .....	332
6.7.11	Load Bay Type Line, Cross-Sliding Car .....	337

6.8	Tractor.....	342
6.8.1	General Behavior.....	342
6.8.2	Hitch Wagons to the Tractor .....	342
6.8.3	Loading and Unloading of Trains.....	345
6.9	Model Transporters with Battery .....	349
6.10	Case studies.....	353
6.10.1	The Plant Simulation Multi-Portal Crane Object .....	353
6.10.2	Simulation of a Forklift .....	357
<b>7</b>	<b>Simulation of Robots and Handling Equipment.....</b>	<b>363</b>
7.1	PickAndPlace .....	363
7.1.1	Attributes of the PickAndPlace Object.....	364
7.1.2	Blocking Angle .....	366
7.1.3	Time Factor .....	367
7.2	Simulation of Robots.....	368
7.2.1	Exit Strategy Cyclic Sequence .....	368
7.2.2	Load and Unload of Machines (Single Gripper) .....	369
7.2.3	Load and Unload of Machines (Double Gripper).....	370
7.2.4	PickAndPlace Loads Containers .....	372
7.2.5	Assembly with Robots .....	373
7.2.6	The Target Control of the PickAndPlace Object.....	375
7.2.7	Consider Custom Transport and Processing Times.....	377
7.2.8	Advantages and Limitations of the PickAndPlace Object.....	380
7.3	Model Handling Robots Using Transporter and Track .....	380
7.3.1	Basic Model and General Control .....	380
7.3.2	Partial Parameterized Control Development .....	386
7.3.3	Handling and Processing Times of the Robot .....	389
7.3.4	Synchronous and Asynchronous Control of the Robot .....	397
7.4	The LockoutZone .....	403
7.5	Gantry Robots .....	405
<b>8</b>	<b>Warehousing and Procurement .....</b>	<b>411</b>
8.1	Buffer .....	411
8.2	The Sorter.....	412
8.2.1	Basic Behavior .....	412
8.2.2	Attributes of the Sorter.....	412
8.2.3	Sort by Method.....	415
8.3	The Store, Warehousing.....	416
8.3.1	The Store .....	417
8.3.2	Chaotic Warehousing .....	417
8.3.2.1	Inventory, Process of Storage.....	419
8.3.2.2	Structure of the Inventory (Table Stock).....	419
8.3.2.3	Looking for a Free Place .....	419

8.3.2.4	Store and Register Parts .....	421
8.3.2.5	Find a Part and Remove It from the Warehouse.....	422
8.3.3	Virtual Warehousing .....	423
8.3.4	Extension of the Store Class.....	428
8.3.4.1	Search a Free Place, Store, Update Stock List .....	429
8.3.4.2	Search for and Retrieval of Parts.....	431
8.3.4.3	Stock Statistics .....	432
8.3.5	Simplified Warehousing Model .....	434
8.3.6	Warehouse Key Figures .....	439
8.3.7	Storage Costs.....	443
8.3.8	Economic Order Quantity .....	443
8.3.9	Cumulative Quantities.....	445
8.4	Procurement .....	446
8.4.1	Warehousing Strategies.....	447
8.4.2	Consumption-Based Inventory Replenishment .....	447
8.4.2.1	Order Rhythm Method .....	447
8.4.2.2	Reorder Point Method .....	455
8.4.2.3	Goods Receipt Warehouse, Reorder Point Method.....	461
8.4.2.3.1	Warehouse Retrievals .....	470
8.4.2.3.2	Deliveries.....	475
8.4.2.3.3	Inbound, Out-of-stock Part .....	477
8.4.2.3.4	Visualization of the Database Stock .....	481
8.4.2.3.5	Storage and Retrieval Orders .....	483
8.4.2.3.6	Warehouse Statistics (Database).....	485
8.4.3	The StorageCrane Object .....	486
8.4.3.1	Store and Remove Automatically with the StorageCrane.....	486
8.4.3.2	Customized Storage and Retrieval Strategies.....	488
8.4.3.3	Stock Statistics of the StorageCrane Object.....	492
8.4.3.4	Load and Unload the Store with a Transporter ....	494
<b>9</b>	<b>Simulation of Workers.....</b>	<b>499</b>
9.1	Exporter, Importer and Broker .....	499
9.1.1	Function.....	499
9.1.2	Exporter and Broker Statistics.....	501
9.2	Worker .....	501
9.2.1	The Worker-WorkerPool-Workplace-FootPath Concept ....	502
9.2.2	The Broker .....	503
9.2.3	The WorkerPool .....	503
9.2.4	The Worker .....	505
9.2.5	The Footpath .....	506
9.2.6	The Workplace .....	506
9.2.7	Worker Transporting Parts .....	507