LIST OF SYMBOLS, TERMS AND EXPRESSIONS

This list of symbols, terms and expressions gives an explanation or definition of how they are used in this thesis. Most of them are defined in the references listed.

Symbol	Reference	Explanation
activity	sec. 1.1.4	an activity is a time consuming action performed by an entity. There is a set of conditions under which it may start. An activity is often limited by two events; start up and finishing the activity. In the post office case examples of activities are the actions of buying a stamp and leaving the office
AI	artificial intelligence	a type of software computer programs that can solve problems in a way that would be considered intelligent if done by a human
animation		showing the layout, and products moving around on the screen during simulation
artificial intelligence	AI	see AI
ASIST		activity based, data driven simulator developed by Kent Fisker, DTH
batch production	ref. [10]	production of a product in small batches or lots by a series of operations, each operation being carried out on the whole batch before any subsequent operation is started
batch size	lot size	the number of products or components of the same type being operated together before they are moved and can start the next operation
bottleneck		the resource with least capacity available compared to the required capacity. Highest ratio of required capacity/available capacity
clamping		the operation of planning of work piece, with its fixtures, etc., into a machine

computer simulation	Taylor [5], sec. 1.1	simulation is a numerical technique for conducting experiments on a digital computer, which involves certain types of mathematical and logical relationships necessary to describe the behaviour and structure of a complex real world system over extended periods of time
continuous		a system where the states of the physical objects or variables may have any values within a range (which may be ∞). Opposite to discrete system
Cricket Graph		business graphics software package
data collection		finding, calculating and extracting information/data (figures, rules, names, etc.) from a real system
de-clamping		the operation of removing of work piece, with its fixtures, etc., from a machine
decision support		here: information that assists in the decision making process
delivery performance	sec. 5.3.2.1	can be measured in many ways. Here: the percentage of requests (orders) that can be executed without delay for the customer
DEMOS		Discrete Event Modelling on SIMULA. A class (a set of declarations and routines) in SIMULA, specially to be used for making discrete event simulation models
discrete event		an event changing a parameter of an object from one discrete state to another
discrete production	ref. [10]	the manufacturing of discrete products, as opposed to manufacturing in continuous flows
distributed production management		management functions, like planning dispatching, etc., are performed as close as possible to where the operations take place. High degree of self controlled groups

entity		an object in a discrete event simulation that has a behaviour: it creates discrete events
ES	expert system	knowledge based systems where the knowledge is at expert level
event	sec. 1.1.4	an event defines the simultaneous state changes in the model. The event is connected to an entity, and nothing happens between the events. In a model of a post office the opening of the office, the arrival of a customer and the ordering of a stamp are all events
event list	trace	a complete list of all events that has occurred in a simulation experiment
Excel		a spreadsheet, a type of software program
experiment	simulation experiment	setting the parameters of a model and running a model a number of replications
expert system	ES	see ES
factory planning		deciding on the rough and detailed layout of the factory floor. Includes deciding on type, number and placement of each machine and other resources
FIFO		first in first out, a priority rule
graphical modelling		creating software models by using graphical symbols (and not by programming)
inventory turnover	sec. 5.3.2.1	the number of times, the average value of all stocks and WIP is sold per year. The ratio turnover/average inventory
jobbing shop production	ref. [10]	very low volume production runs of many different products, with low level of standardisation, and few common components
KBS	knowledge based systems	advanced programs that can solve a variety of problems based on stored knowledge, without being reprogrammed

knowledge acquisition		the process of extracting information or knowledge from experts
knowledge based systems	KBS	see KBS
layout		the factory floor, but also a "map" of the factory floor
LIFO		last in first out, a priority rule
lot size		see batch size
Macintosh		a personal computer
macro		a set of functions put together, a mini software programme
mass production	ref. [10]	large volume production runs of relatively few, highly standardised products, with stable demand and few design changes
mean time between failure	MTBF	the estimated time between each time a machine breaks down
model	sec. 1.1.1	a description or representation of a real or virtual system
model building	sec. 1.1.2	the process of transferring a model design into a model
model design		deciding on the logic of model
modelling		the process of creating models. Includes model design and model building
monitor		here; watching the simulation model, or at least central parameter during simulation
Monte-Carlo simulation		In Monte-Carlo simulation the utilities of generating random distributions and the data collection devices are included. This is, of course, the heart of any dynamic modelling technique

MRPII		Manufacturing Resource Planning, a principle which is the basis for computer systems for production control. Uses Bills of Materials and Bills of Processes, standard lead times, etc., to perform net requirements calculations as well as resource planning
MTBF		mean time between failure
NTH		The Norwegian Institute of Technology
numerical		expressed in or counted by numbers
object orientation		a system or model where the information is organised by objects of different types, representing the different real world objects or elements
operative simulation	sec. 1.5.2	use of simulation for decision support of operational decisions in production management
post processing		processing data, information or results after the main operation (process) has taken place. Here; calculation on data that is produced during a simulation experiment
process	sec. 1.1.4	a process is a sequence (in time) of events all concerning the same entity, often called the life cycle of the entity. In the post office the sequence; customer arrives, orders stamp, pays for stamp, receives stamp and departs from office, is a process
product flow		in SIMMEK; all information about products; quantities, operations, routings, sales prices, etc.
production management		the function of controlling the pulse of the manufacturing system, by decision on what and when to make and buy
production management systems		computer systems for production management

pseudo programming		making instructions for a computer without using a basic programming language like C or FORTRAN, but on the other hand neither by natural language nor graphics
queuing theory	sec. 1.1.5	queuing theory is the study of the randomly fluctuating waiting lines, or queues
replication		a replication is one "run through" of a model with its initial conditions/values. For reliability reasons the same model with the same conditions/values is run several times (replications) with different seed
scheduling		the planning operation of connecting each operation to a specific resource, and fixing the time when this operation should take place. Often referred to as detailed planning
seed		normally a value between 0 and 1. Used to give each replication a unique starting value for drawings from statistical distributions. The first drawing transforms the seed into a value of the distribution, the next drawing is found by changing the seed by an algorithm into a new value between 0 and 1
series		see batch sizes
series effect		the effect that if a machine needs to be set-up before the operations can start, then the more parts you can make without a new set-up, the shorter average operation time. There are more parts to split the set-up time on. Includes also learning curve effects
set-up		to prepare a resource for a certain type of operation, ex; changing a tool. Does not include clamping and de-clamping of each work piece
SIMAN		a simulation tool, somewhere between a simulation programming language and a simulator. Specially for simulation of manufacturing systems

SIMMEK		a simulator for simulation of manufacturing systems and a Norwegian research programme
SIMULA		an object oriented programming language, well suited for writing simulation programs
simulation	Naylor [5], sec. 1.1	see computer simulation
simulation kernel		the part of the simulator that is executing the actual simulation
simulation process		the entire process from facing and defining a problem until conclusions are drawn from a simulation of the underlying system
simulator		a software tool for making simulation models where no programming is needed
SINTEF		The foundation for scientific and industrial research at NTH
slack (time)		the difference between the sum of planned operation times and available time. Can be positive or negative
SLAM II		a simulation tool, somewhere between a simulation programming language and a simulator. Specially for simulation of manufacturing systems
spreadsheet		a software with tables and cells, relations between the cells, and with graphical presentation of the values in the cells, rows and columns
Statworks		a statistical software package working with tables of data
ST-POINT		scheduling software system
strategic simulation	sec. 1.5.2	use of simulation for decision support of strategic decisions in production management
tactical simulation	sec. 1.5.2	use of simulation for decision support of tactical decisions in production management

throughput		the number of products and components coming out of a manufacturing system over a defined period of time
throughput time	sec. 5.1.1	here; the time from the first operation can start on one batch, until all parts are complete in the last operations. Can be measured in many ways, see Section 5.1.1
trace		see event list
uncertainty		that a parameter is not deterministic
validation	sec. 4.2	to check whether the simulation model is a good (enough) description of the real system
verification	sec. 4.2	to check whether the computer simulation program and the model do what it is intended to do
warm up time		the elapsed simulated time from the start of the simulation till the time where result collection is started
WITNESS		a simulator for simulation of manufacturing systems
world views		here; a "parameter" saying whether a simulation system or model is activity, event or process oriented
ZETA-MPS		an MRPII based software system