Alternative Routing Methodologies

For most simulations the routing arrows between simulation objects, along with the disciplines available in “Routing Out” control the flow of work around the simulation and determine the sequence of work at each work center.

Using the routing arrows the emphasis is on the work and where it flows, typically taking a number of alternative routes through the simulation.

These can be enhanced by use of additional methods that look at the simulation in different ways. All the methodologies can be mixed in the same simulation.

The Jobs Matrix

Using the Jobs Matrix the emphasis is still on the work flowing in the simulation but the Jobs Matrix can make it easier to handle situations where there are a large number of options about where work can flow, including multiple repeat passes through the same work centers or many ways of performing the same task on an item of work.

The Cycle Matrix

Use the Cycle Matrix when the emphasis is not on the flow of work, but rather the sequence of steps taken at a work center. For example if you think about work in terms of a work center doing a series of tasks like :

Wait for base plate
Pick up and fit first sub assembly
Pick up and fit second sub assembly
Place complete assemble in out basket

then use the Cycle Matrix.

Visual Logic

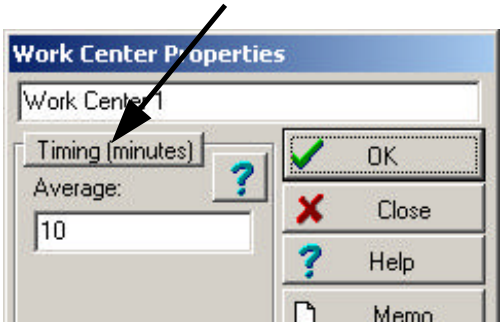
Visual Logic is often used with the basic routing arrow methodology (when label values control routing) but sometimes Visual Logic is used to take over all routing but not using routing arrows and simply using Visual Logic to move work between storage bins to control what work can take place in the simulation. This is the most advanced, but also the most time consuming way to create simulations (it is the way all simulations used to be coded before simulation software was widely available).

Jobs Matrix - How to use it.

[Jobs Matrix section goes here]

Cycle Matrix - How to use it.
The cycle matrix defines the cycles of activity at each work center that uses the cycle matrix.

Set a work center to use the Cycle Matrix using the work center's Timing orientation dialog.



If a work center uses the cycle matrix then the work center's timing and routing decisions are controlled by the cycle matrix.

To view the cycle matrix use Objects/cycle matrix in the SIMUL8 main menu

Rows in the Cycle Matrix:

Each row represents a stage in the list of tasks that work centers cycles through. Rows that relate to one work center are always collected together in the cycle matrix.

Immediately after the simulation is reset each work center using the cycle matrix will start to try to perform the first task listed for it in the cycle matrix. After a work center has completed its last task in the cycle matrix it will start again at the first row in its list.

Columns in the Cycle Matrix:

Work Center

Name of the work center. Click the cell and type the name of the work center of double click the cell and select from a list of available work centers.

If a cell is blank then it assumes the same work center as the row above it in the cycle matrix.

Task Number

This is an integer number and is usually the sequence number in which the work center does work. For example each row in the cycle matrix for a work center will have a value one higher than the pervious. However this number is only used by SIMUL8 to cross reference between rows and SIMUL8 will

search all the rows for the value it needs. So there is no requirement to number the tasks sequentially.

Task numbers must be positive.

Description

Any text to act as a reminder about the task (not used by SIMUL8)

Task Type

The type of task to be performed. Type the text name of the task or double click to choose from a list of available types. The Task Type affects the meaning of some other cycle matrix columns.

Double click a cell in this column to choose one of the following task types

The following Task Types are available:

LOAD

Load a work item from the simulation object listed in the “From/To” column. If the “Work Type” and/or “Job” columns are empty then any work item may be loaded from the specified objects (using priority rules defined externally to the cycle matrix), otherwise the “Work Type” and/or “Job” columns are used to check the labels of the work items available in the specified object and only work items that match will be loaded. (Work Type must match the value in the work item’s label “Work Type” and Job must match the value in the work item’s label “Job”)

The Time column determines the time taken to perform the loading operation.

If the work item is not available for loading then the work center will wait in this stage until it is able to start the loading time. (See Waiting% result column below).

UNLOAD

Send the work item to the simulation object listed in the From/To column. If this route is blocked then record time in the Waiting% result column - see below.

WORK

Work for the amount of time in the Time column (the time may be a reference to a distribution or calculation).

WAIT

Do nothing until the simulation object in the From/To column is in the State in the State column. The state can be defined with a generic state such as “EMPTY” or “LOADED” or may be a TaskNumber listed for the referenced work center elsewhere in the cycle matrix. A work center can reference itself for this type of task. For example WC1 might WAIT until WC1 is LOADED because some other work center in the cycle matrix has a task that will UNLOAD to WC1.

Values in the State column must be positive.

WAITEND

Do nothing until the simulation object in the From/To column has completed the State in the State column. If the simulation object in the From/To column is not in the specified state when this row of the cycle matrix is entered, then wait until the simulation object in the From/To column is in this state and then wait until it is complete.

“EMPTY” and “LOADED” (see WAIT above) are not supported for this type of task.

Values in the State column must be positive.

GOTO

Instead of going to the next row in the cycle matrix go to the task number in the State column. The number may be a variable or calculation. If the result of the calculation is -1 the work center will wait in this state. If the result of the calculation is 0 the work center will go to the next task in the list whatever its task number. Immediately before the calculation is evaluated, the Visual Logic in the Visual Logic column will be obeyed.

Work Type

Can be blank or a value to specify the required value in the work item’s “Work Type” label. (See Task Type LOAD above)

Job

Can be blank or a value to specify the required value in the work item’s “Job” label. (See Task Type LOAD above)

From/To

For tasks that communicate with other simulation objects this column contains the name of the simulation object. Type the object name or double click the cell to select from list of available objects.

Time

Used to specify the time for the stage of the cycle

The time the stage will take in time units specified in SIMUL8's Clock / Properties menu. Alternatively specify the name of a SIMUL8 named distribution to be sampled to obtain the time or the name of a SIMUL8 Global Data Item variable that will contain the time, or a calculation to obtain the time.

State

Used to specify a stage to wait for, depending on the content of the "Task Type" column, see above.

Text or a Task Number that some work center must be in.

For example if the work center should wait until "MyOtherWorkCenter" is in its cycle matrix row that contains "26" in column "TaskNumber" then enter 26 in the State column and WAIT in the TaskType column. Alternatively if the work center should just wait until "MyOtherWorkCenter" is empty then enter "EMPTY" in the TaskType column.

Permitted values for State are any positive integer value, "EMPTY" or "LOADED". ("EMPTY" and "LOADED" are not supported for WAITEND Task Types)

Image

The image to be displayed while the work center is in this stage. Type the name of the SIMUL8 Image (from Graphics / Images list) or double click the cell in the cycle matrix to select from the available list. Leave this column blank to have SIMUL8 use the images listed in the normal Work Center/ Graphics image animation dialog.

Stage

(read only) If the simulation has been run and the work center has referenced the cycle matrix to decided what to do next then this column will indicate with and arrow the currently active stage of the cycle at the work center.

Waiting%

(read only) Results data. The percentage of time the work center has spent in this stage but not actually performing the stage because the work center had to wait to start the stage. (For example, for a LOAD stage the work center will record waiting time in the stage if the required work item is not available to load.)

Active%

(read only) Results data. The percentage of time the work center has working at in this stage. For some stage types this will always be zero (for example WAIT type stages, where as soon as the waiting reason is satisfied the work center moves to the next stage in the cycle.)

Cycles

(read only) Results data. Number of times the cycle has been started.

Visual Logic for bin to bin routing

[Example on using Visual Logic for bin to bin routine goes here]