Job Shop Modeling Webinar August 28, 2018

Modeling High Mix processes in Process Simulator



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Agenda for this Webinar

- Explore characteristics of "Job Shop" production systems
- Methods for modeling job shop-like processes in Process Simulator.
- Examples
 - Intuitive or "Brut Force" method for modeling a job shop.
 - Generic template you can use for any high mix batch processing model
 - Specific example of a job shop-like model in the food processing industry



Characteristics of Job Shop Production

- Job shops represent production systems that produce a high mix of products that can be made using the machines and equipment available on the shop floor.
- Even large flow manufacturing facilities may have their own job shops for making special tooling that is needed on the flow lines.
- Job shops typically run batches of products through their work centers due to the long setup times required to perform each operation.
- Job shops typically use common or generic equipment rather than specialized machines that excel in performing a single operation.



A Typical Job Shop Environment

Production Work Centers





Example 1: Job Shop Model Demo

This model represents the "brut force" method of job shop modeling.

It contains:

- 2 Product Types - 4 Work Centers

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You can see that with only 2 product types and 4 work centers the Routings are getting messy. If you tried to do this with 20 product types it would likely be impractical. Typical Job Shop Environment





This model provides a general template for modeling job shops of any size.

Example 2:

As built it contains:

- 100 Product Types
- 25 Process Stations
- 50 Tool Types
- 5 Labor Teams

It can be easily modified To fit various job shop modeling situations.





Tool Crib





Labor Pools



Model Constructs

- Excel Tables
 - Routings
 - Labor Types
 - Tool Types
 - Processing times
- Arrays
- Attributes
- Macros
- Variables
- Flexible Route
- Subroutines





Master Worksheet

- The Master Worksheet contains "n" rows for each product type. The data elements are automatically copied to other worksheets that contain just one type of data for each product at each process step.
 - The Routings worksheet contains only the routing data for each product
 - The Labor worksheet contains only the Labor used at each step in the process
 - The Tool worksheet contains only the Tool used for each product at each step
 - The Op_Time worksheet contains only the operation times at each step

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The Routings Worksheet

- Routing data (activity names) for each step in the process is contained on a single row for each product type.
- You can have multiple routing operations by modifying the Master!

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Using Index Numbers for Indirect Reference

- Process Simulator allows you to indirectly specify an Entity Name, an Activity name or a Resource name by using the Index Number of that Entity, Activity or Resource.
- To see the Index Number of an object, look in the Object Explorer and click on the # symbol.

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Using vLookup to generate the Index #'s

 Next, use Excel's vLookup function to create an index number table from the data with the Routing, Labor and Tooling specifications.

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The Labor Worksheet

- Labor used for each step in the process is contained on a single row for each product type.
- You could specify number of labor units by modifying the Master!

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The Tools Worksheet

- A Tool or any other type of resource needed for each step in the process is contained on a single row for each product type.
- You could specify multiple tools or units by modifying the Master!

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The Op_Times Worksheet

- Time spent at each activity is specified in this worksheet. This time includes the use of the labor unit and the activity itself.
- You could separate Operator & Run times by modifying the Master!

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Attributes - hold "active" info for each Entity

- a_Product = Product Type (e.g. 1 = product type 1, 2 = type 2)
- a_CycleStart = the entity's arrival time to system
- a_BatchSize = the batch size that is represented by the entity
- a_Proc_Step = the entity's current step in the process
- a_Destination = the next Activity where the entity will be sent
- a_Labor = the resource index number of the specified labor type
- a_Tool = the resource index number of the specified tool type
- a_OpTime = the operation time that will be taken at the current step. This includes the use of any Labor and Tool elements that are specified.



Arrays

- Four arrays are used in the template
 - y_Routings reads the routing data from the Routings worksheet
 - y_Labor reads the labor resource data from the Labor worksheet
 - y_Tools reads the tool resource data from the Tools worksheet
 - y_OpTimes reads the operation time data from the Op_Times worksheet



Macros

- This template uses Macros for global substitution parameters
 - m_MoveTime is a generic move time for entities moving from any Activity to any other Activity.
 - m_LaborAvail is a general resource availability setting that is used to specify a PF&D (personal fatigue & delay) factor on each labor type. You could add macros for each Labor type if you need specific factors for each Labor type.



Variables

- This template uses Variables to track Work in Process (WIP) and Cycle Time of each entity from arrival to exit.
- You can add any variables that you want to track whatever type of information you need to track. Or, use them for decision making in your subroutine.



Subroutines

- This template uses a Subroutine to apply common processing logic to each entity at each step in the process.
- Upon arrival at each Activity the Subroutine logic performs the following steps...
 - Increment the Process Step attribute
 - Set the Labor, Tooling and Operation Time attributes
 - If a Tool is required, capture that resource
 - If a Labor resource is required, use that resource for the Operation time, otherwise remain at the Activity for the operation time (without a resource)
 - Free all resources used
 - If the process step is less than 25 then set the Destination attribute to the next Activity.



Example 3:

This model is a specific example of using the Job Shop Template to model a high mix, high volume batch production system in the food processing industry.

The Master worksheet was modified to meet the specific needs of this system.





Master Worksheet for Food Processing Demo

- This Master Worksheet contains 5 rows for each product type. The additional data element specifies the number of labor units needed for each product at each process step.
 - The Routings worksheet contains only the routing data for each product
 - The Labor has two elements... Type & Quantity (number of units) at each step
 - There are two time fields in this model... one for the time with the labor unit(s) and the other for the automated machine time (e.g. time in the oven).

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- Thanks for attending this "Job Shop Modeling with Process Simulator" Webinar! We hope it was helpful.
- Remember, help is only an email or phone call away.
- Good luck and happy modeling!

Technical Support 888-776-6633 support@promodel.com 6 am - 6 pm M-F, Mountain Time

