An OO Process Flow Approach to ARGESIM Comparisons C2 'Flexible Assembly System' with AnyLogic

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Simulator: AnyLogic (www.xjtek.com) is an object – orientated, general-purpose simulator for discrete, continuous and hybrid applications. It supports modelling with UML – RT and the underlying modelling technology is based on Java. Since Version 4.5 AnyLogic provides different advanced libraries as the Enterprise Library which implements often used discrete model object classes like sources, conveyors, sinks …

Model: As the Comparison addresses the possibility to define and combine submodels, the object-oriented approach of AnyLogic, using the Enterprise Library, seems natural. The model consists of eight stations (see Fig. 1) connected by some conveyors (all predefined in the Enterprise Library).

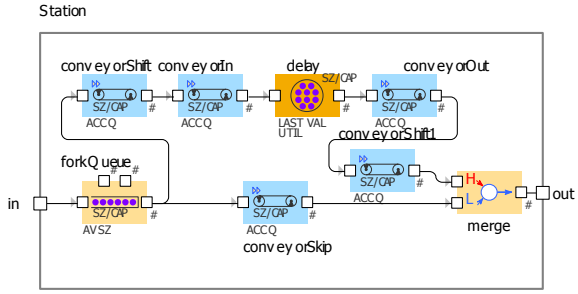

Fig. 1 Active Object Class Station

The instances of the station class and their connection as well as initialisation objects are defined in the Model class (see Fig. 2).

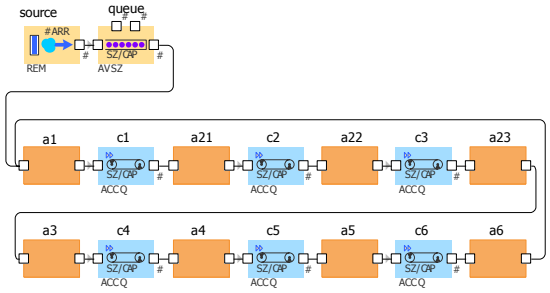

Fig. 2: Model Class

Model Analysis. Some results may be achieved by a brief analysis of the situation and can be used for validation of the model:

- Max. number of processed pieces: The fact, that machines of type two are the bottleneck of the system we gain a maximum number of 1440 processed pieces during an observation time of 480 minutes.
- Minimum throughput time: 16 m with speed 0.3 m/s plus complete shifting time of 20 s plus complete operation time of 135 results in a minimum throughput time of 208,33 s.

Task a - Control strategy, Method of Statistical Evaluation: Choosing local implementation of control strategy is a natural way for object-oriented modeling. Each station controls its flow of pallets. Statistics are collected within the model using the AnyLogic dataset class and can be observed using AnyLogic Viewer.

Task b - Simulation Results: A parameter loop with an increasing number of pallets was used to control multiple simulation runs. The focus of investigation was on throughput and average throughput time.

Throughput increases almost linear and reaches the threshold of ~ 1440 pallets/480 min. with usage of 17 pallets. There are minor oscillations about the threshold of 1440 pallets depending on the state of pallets at time 120 min (begin of inspection). Throughput time increases slightly in the range from one to 17 pallets and raises virtually linear afterwards. Evaluation was made from one to 30 pallets, 40 pallets and 60 pallets (see Fig. 3).

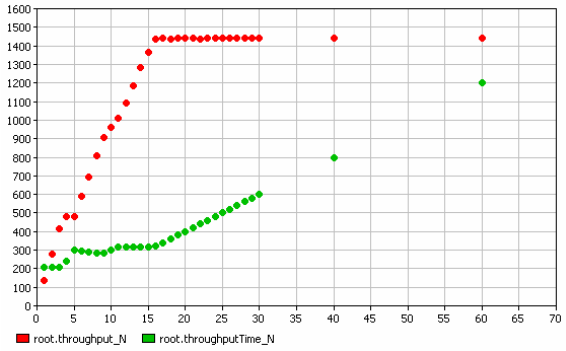

Fig. 3: throughput, average throughput time

Task c – Optimisation. Optimisation depends on the objective function. Optimal results with emphasis on maximal throughput can be extracted from results of task b (optimisation by parameter variation): Maximal throughput is reached for 17 or more. Since we get minimal throughput time (with max. throughput) with 17 pallets, the optimal solution is 17 pallets.

C2 Classification: OO Process Flow Approach

Simulator: AnyLogic 5.0.1, 2004