FACTORY MODELLING, SIMULATION. AND SCHEDULING IN THE INTELLIGENT MANAGEMENT SYSTEM

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The programs to be demonstrated are the factory modelling, simulation, and scheduling facilities of the Intelligent Management System (IMS), being designed and constructed in the Robotics Institute of Carnegie-Mellon University. The IMS is a long term artificial intelligence and management science research project, whose goal is to integrate and automate the running of the "Factory of the Future."

Factory Modelling: In order for any "intelligent" system to carry out a management function it must have a factory model that incorporates all the information necessary to sustain the function. For example, s simulation system requires knowledge of existing processes including process times, resource requirements, and its structural (routing) relation to other processes. It must also know when routings for products are static, or are determined by a decision process such as a scheduler. In the latter case, it must know when and where to integrate the scheduler into the simulation. If the IMS is to generate the sequence of events to produce a new product, it must have knowledge of the processes (e.g., machines) which includes the type of proc - easing it can do, its operating constraints, the resources it consumes, and Its operating tolerances. If data is to be changed in an interactive, possibly natural language mode, the IMS must have knowledge of generic processes such as machines, tasks, and departments if it is to understand the interaction. It must also know what information is important and how it relates to other information in order to detect missing information and inconsistencies. Hence, the organizational model must be able to represent object and process descriptions (structural and behavioral), and functional, communication and authority interactions and dependencies. It must represent individual machines, tools, materials, and people and also more abstract concepts of departments, tasks, and goals. An interactive program for constructing and altering factory models will be demonstrated. The modelling system is based on the AI knowledge representation system, SRL.*

*Fox M.S., (1981), "SRL: Schema Representation Language", Technical Report, The Robotics Institute, Carnegie-Melion University, Pittsburgh, PA to appear

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Factory Simulation: An extendable, interactive discrete simulation system has been constructed that interprets the factory model directly. It allows the user to dynamically query the simulation for state information (e.g., state of a machine, process, etc.), where objects are located (e.g., what operation is being carried out on an order), and regular statistical analyses. It also allows the user to alter the factory model before and during simulation. The factory can be simulated and displayed (on a color graphics device) at variable levels of detail. The simulation system is integrated with the scheduling system to allow the testing of scheduling heuristics and/or changes to the factory model.

Factory Scheduling: An interactive, real-time, job-shop scheduling system has been constructed which interprets the factory model directly. It allows the user to enter orders and associate scheduling constraints such as time, cost, operations, and machines. The system will generate a schedule that attempts to satisfy the constraints. The system uses a knowledge-based heuristic search to construct forward (from start date) or backward (from due date) planned schedules. The user also specifies state information for the factory (e.g., machine failures, maintenance, order finished on a particular machine, etc.). The system does a minimal rescheduling in reaction to any state change of the factory.