Agent-Based Adaptive Production Scheduling – A Study on Cooperative-Competition in Federated Agent Architecture

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Abstract. An increasingly popular method of improving the performance of complex systems operating in dynamic environments involves modeling such systems as social networks made up of a community of agents working together based on some basic principles of social interaction. However, this paradigm is not without its challenges brought about by the need for autonomy of agents in the system. While some problems can be solved by making the interaction protocol either strictly competitive or strictly cooperative, some other models require the system to incorporate both interaction schemes for improved performance. In this paper, we study how the seemingly contradictory effects of these two behaviours can be exploited for distributed problem solving by considering a flexible job shop scheduling problem in a dynamic order environment. The system is modeled using federated agent architecture. We implement a simple auction mechanism at each processing center and a global reinforcement learning mechanism to minimize cost contents in the system. Results of simulations using the cooperative-competition approach and the strictly competitive model are presented. Simulation results show that there were improvements in cost objectives of the system when the various processing centers cooperated through the learning mechanism, which also provides for adaptation of the system to a stream of random orders.