

## **241e The Smart Flow-Chart: Next Generation Access to Chemical Engineering Models, Data and Knowledge**

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The paper presents early research in the development of smart flowcharts that are driven by agents to access, manage and monitor information that relates directly or indirectly with the chemical engineering flowchart. The conventional flow-chart is revised with the understanding that each process units are linked with models, data-bases, property banks, reports, on-line data, design data and even internet-based information. A paradigm is proposed where agents are employed to produce flexible and dynamic access to the heterogeneous and distributed information sources. The agents are used to support the interoperation of data and services in a dynamic and open environment as well as to facilitate the integration of information, coordinate manufacturing execution, and to help engineers making decisions on the basis of up-to-date information.

The multi-agent system uses ontologies to account for the diversity and heterogeneity of the information sources, coordinate the distinct but complementary tasks, and facilitate the interoperation of software or application programs. Artificial intelligent technique such as artificial neural network (ANN), rule-base decision support are integrated and illustrated for process monitoring, diagnosis, process performance prediction and operation suggestion. The Java Agent Development Framework (JADE) is used as the basis to develop the multi-agent system. With a common communication language and shared ontologies, agents can communicate and cooperate with each other to exchange and share information, and achieve timely decisions in dealing with various enterprise scenarios. The application of software agents supports communication between previously established application software and programs for process simulation, optimization, scheduling and process performance prediction. This can reduce the necessary modifications of these applications to the minimum. In such a system, agents cooperate in performing their tasks with a shared resource. The cooperation and coordination feature between agents in the multi-agent system facilitate the information system development with the requirement of information integration, coordinate manufacturing, and cooperate decision-making. The system performance is reliable, flexible, extendable and reusable. The modularity of the system makes it easier to maintain, and functionally specific agents can be reused in different agent teams to solve different problems. The application of MAS has been discussed through some example scenarios in information retrieving, process monitoring, process performance prediction, and utility system optimization.

Key words: Software agents, multi-agent system, decision support, artificial intelligent.