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ABSTRACT

Strumenti per la simulazione: dal “Discrete Event Simulation” all’ “Agent Based Modeling”.

Lo stato dell’arte attraverso lo sviluppo di casi reali e la sperimentazione delle nuove metodologie.

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ABSTRACT

This PhD thesis presents the course of research characterized by application of simulation tool to production systems.

First, an optimization study by DES methodology of paper mill is presented. After gained long-standing experience in DES methodology, advantages and disadvantages are indicated.

From modeling point of view, DES proposes model building by combination of standard logical blocks in order to reproduce process flow. This kind of approach adapts to simulate manufacturing production system especially human factors are not considered. Besides, this approach requires a depth detail level. From user point of view, more details means higher accuracy and credibility of models. Notwithstanding, DES is "data hungry" methodology respect other ones.

Another important aspect concerns complexity: even if, in the last years some firms are using these DES tools, many times optimization studies are conducted by external consultants because internal staff does not have skills requested. DES application requires high training costs and high modeling costs due to long building model time.

A software architecture is presented to speed up building of models and to simplify use to not-expert user. The results in terms of modeling time and number of elementary operation are compared to traditional procedure of QUEST (software DES). The evaluation is done by building of lots models of production system and to rebuild paper mill model. The result showed a reduction of 50% in terms of modeling time.

Last part of this research presents a simulation study based on agent (Agent based simulation) realized on DRC system. In particular, flow shop assembly line is considered.

Assignment operator rules are implemented to model "workforce flexibility". ABM permits to realize a model of assembly line with 8 assembly station and inter-operational buffers. The complexity of modeling assignment rules was overcome thanks to ABM modeling. Three kind of agents was defined: "Machine", "Product" and "Operator". Agents can exchange information among their and show a behavior based on fixed defined rules.

DOE and ANOVA analysis was conducted to evaluate the system in terms of system effects and human effects." A comparison with literature was done. ABM methodology showed bigger potentialities to embed human factors in operations than other methodologies.