

PROCESS CONTROL BY AN EXPERT SYSTEM AT THE GRANDPUITS REFINERY

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Abstract

In this paper, we describe an Expert System (ES) application which supervises the hydrogen distribution in the Grandpuits refinery (France). After the installation of an on-line operator adviser (1989 November), a modification has been asked by the operating staff, so that ES messages could directly operate on the process ; it has been done and the loop has been closed in 1990 October.

1 - Introduction

Due to the increasing demand of high quality fuels, the use of hydrogen becomes critical in refineries ; for our refinery in Grandpuits, there is only one hydrogen producer unit and several - permanent or occasional - consumers. This situation requires some gas importation in order to fill the deficit, and there was a demand from the refinery for a system achieving the optimal hydrogen balance.

For automation or regulation, a process model is needed. In our case, there is no simple mathematical model to solve the problem, and the knowledge of unit constraints was distributed among several persons. So, we decided to create a system based on a modeling of unit control done by humans and not the modeling of process itself.

2 - Project development

The expertise collected in the system represents a consensus between people from different activities (process team, operating staff) for which constraints are different, but

all of them have to be taken into account for optimisation.

In a first step, we developed an operator adviser, and messages were integrated in classical views, because five video displays are already used by the operator to control the units, and it was unacceptable to add a new different screen to display the ES messages.

After a 8 months validation period, the chief operator asked for closing the loop in order to discharge the operators work. This has been achieved in 4 months and this application has worked since October 1990 like other automation modules developed with procedural language (automatic running, equivalent on-line ratio).

3 - Expert system architecture

This expert system is running on a Microvax and is scheduled each 2.5 minutes by the applications monitor. The expertise is encoded as rules using OPS83 language : this tool allows a good knowledge representation and has the facility of dynamic control of rules priority. Moreover, OPS83 code is easily integrated with other languages and can be compiled to build an efficient executable program.

4 - Conclusion

The knowledge of experts of the refinery has been gathered and saved with this expert system, integrating the consensus of people working in different areas.

The use of this system has reduced the operator work, and also generated a 2.4 MF saving in 1990, which represents a return on investment shorter than 6 months.