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A GENERAL-PURPOSE INFERENCE-ENGINE FOR CRAY SUPERCOMPUTERS

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ABSTRACT

A general-purpose Inference-Engine: HAL-1987, on a Cray X-MP supercomputer, used for the development of Production-Rule Analysis Systems, is described. It is programmed in Portable Standard Lisp(PSL), and is currently running under the Cray Operating System (COS) and the Cray Time Sharing System(CTSS). It is used for hybrid Symbolic-Procedural programming methodologies; particularly for adaptive variance reduction in Monte Carlo simulations. It is also used for the generation of Model-Based Systems. Its functioning will be demonstrated for the latter application. The Fault-Tree and Event-Tree Analysis methodologies from Systems-Analysis are used for representation within the framework of the Rule-Based system paradigm. A Goal-Tree is accordingly generated and is then translated into a Knowledge-Base in the form of if/then rules. The Knowledge-Base is searched by the inference engine in the forward or the backward chaining mode. This provides a technique for modelling engineering devices based on the knowledge of their structure and function, rather than on human expertise alone. The Production-Rule system uses an antecedent-consequent logic. The inference engine is flexible and can accomodate general additions and modifications to the Knowledge-Base. Usage is demonstrated in the forward and backward chaining modes for a model for crisis alert and situation-assessment in Nuclear Reactor Safety Analysis.