

Asian Nuclear Prospects 2010

## Simulation and Integrated Testing of Process Models of PFBR Operator Training Simulator

T. Jayanthi, H. Seetha, K.R.S. Narayanan, N. Jasmine, Rashmi Nawlakha, Bindu Sankar, Jaideep Chakraborty, S.A.V SatyaMurty and P. Swaminathan

*Computer Division, Indira Gandhi Centre for Atomic Research, Kalpakkam 603102.*

### Abstract

High fidelity Full Scope Operator Training Simulators play a key role in imparting plant related knowledge to the operating personnel in an effective way. It provides a platform for training the operators on normal and emergency conditions including all types of scenarios that would arise in any Nuclear Power Plant. The scenario based training helps the plant operator to handle a crisis in an efficient manner with the ultimate goal of safe and efficient operation of the plant.

This paper discusses about the general description of PFBR Operator Training Simulator, modeling and simulation of various process models, the complexities involved etc. It also covers the associated process logics, controls, display of alarms and indications, malfunctions and transient incidents related to each process model, integration with other sub systems, individual process model testing, integrated performance testing and verification and validation of models. Simulation of process models are broadly classified into two main categories namely, External Models - that are developed in-house and ported to the simulator environment and Internal Models - that are developed using Simulation Tool. External Models are tested on the desk top for intended functioning and after obtaining satisfactory results, the models are ported to the simulator base wherein the Logical and Virtual Panel Models are built to represent a real system of the plant. Internal Models are built using the Simulation Tools and integrated with the External Models after testing. Combination of External and Internal Model represents the total plant and the performance testing is conducted in an Integrated Mode to qualify the Process Models for training purpose.

© 2011 Published by Elsevier Ltd. Open access under [CC BY-NC-ND license](https://creativecommons.org/licenses/by-nc-nd/4.0/).

Selection and/or peer-review under responsibility of Indra Gandhi Centre of Atomic Research

*Key words: PFBR, simulation, Integrated testing, hardware*

### 1. Introduction

Plant Safety is given utmost importance in any industrial setup especially in Nuclear Power Industry. This is achieved by training the operators in all possible ways to acquire the knowledge about the plant operation under normal and emergency conditions. Apart from classroom teaching and field training, the simulator training is considered to be a value addition to the operator training program.

\*Corresponding author. T el.: +91-44- 27480210; fax: +91-44-27480210  
E-mail :[jayanthi@igcar.gov.in](mailto:jayanthi@igcar.gov.in)

Full Scope Training Simulator has become a well accepted medium of knowledge transfer and is a major step towards enhancing the skill set of the operators. The Human Error which is found to be the main cause of major accidents that have taken place in the past history of Nuclear Industry is the main driving force behind setting up such real time training simulators. In the present scenario, major effort is on towards implementing Real Time, High Fidelity Full Scope Simulators with improved Human Machine Interface at a global level to reduce the human error.

## 2. Brief Description on PFBR Training Simulator

A Full Scope Replica Type Simulator is being developed at Computer Division, IGCAR in collaboration with Reactor Engineering Group (REG). The main objective is to conduct comprehensive training on all reactor subsystems under various plant conditions and enhance the capability of the plant operators.

The **Hardware Architecture** consists of Simulation Computers, Control Panels, Operator Information Consoles, Input/ Output systems, Instructor station, Simulation Network, Power Supply and Distribution system as shown in Fig. 1.

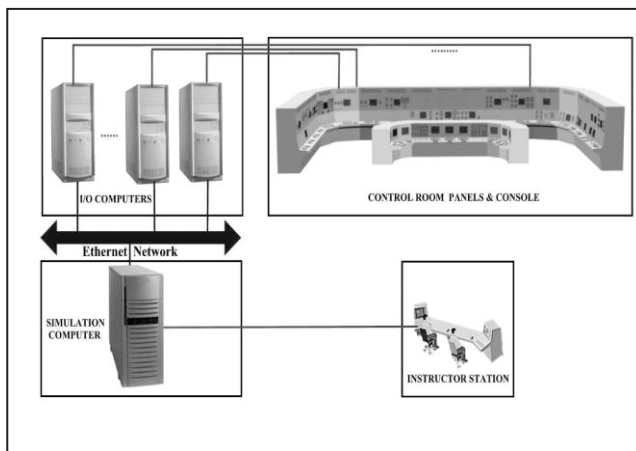


Fig. 1. Hardware Architecture

Simulation Computer executes various Mathematical Models of the Sub-Systems in Real Time. It takes the Inputs from Control Panels and Operator Consoles through I/O Systems, processes them and responds by giving the information to I/O system for display on indicator/meters, recorders and raise alarms in real time. Control Panels are replica of the Plant Control Room Panels made up of mosaic tiles with grid structure.

Operator Consoles handle overall monitoring of the most important and frequently used control signals. Normally, Reactor startup, power raising, normal steady power operation and shutdown are carried out from operator console. Instructor Station facilitates control and monitoring of Simulator Operations / Operator actions and conduct training sessions [1, 2].

Download English Version:

<https://daneshyari.com/en/article/1514937>

Download Persian Version:

<https://daneshyari.com/article/1514937>

[Daneshyari.com](https://daneshyari.com)