

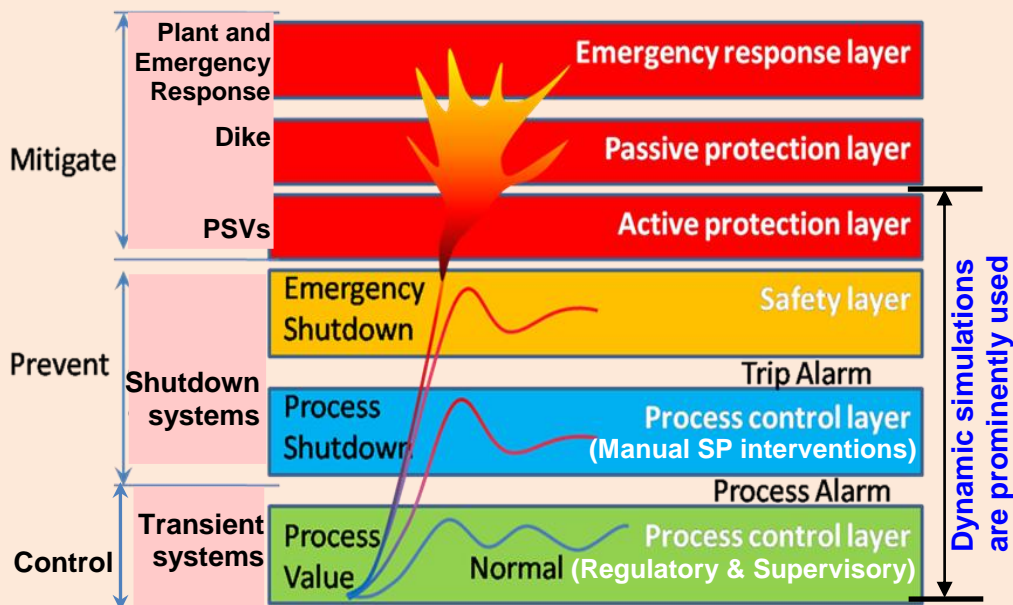
CSIR-Indian Institute of Petroleum (CSIR-IIP), Dehradun

We are a constituent laboratory of the Council of Scientific & Industrial Research (CSIR), India's premier publicly funded research organization. We are engaged since 1960 in R & D across multidisciplinary areas related to petroleum processing, energy, and chemicals. We have developed and deployed more than fifty technologies in petroleum refining, energy conservation, renewable energy and fuels, specialty chemicals, lubricants, etc. We have extensive expertise in Process Engineering (Process design, process scale-up, Technology Information Package development, and processes integration), Separation Technologies, Revamp Studies, Energy Optimization, and much more. We have a proven track record of solving industrially specific problems cost-effectively and delivering optimized solutions tailored to client and site requirements.

Dynamic simulation is a well-known method to address process design-control challenges effectively. CSIR-IIP can also assist the refineries by providing services in process control and dynamics.

The importance of dynamic simulation

Dynamic simulations are useful to develop a clear understanding of transient responses in various operating scenarios. These scenarios include process feed throughput change, feed composition change, utility load optimizations, etc. Dynamic simulations have been proven effective in comparing several control structures and determining the best option in ensuring the safest and most economical operation while pairing the appropriate Control variables (CVs) and Manipulated Variables (MVs). It is an indispensable tool for studying control, prevention, and mitigation effects in chemical process industries.



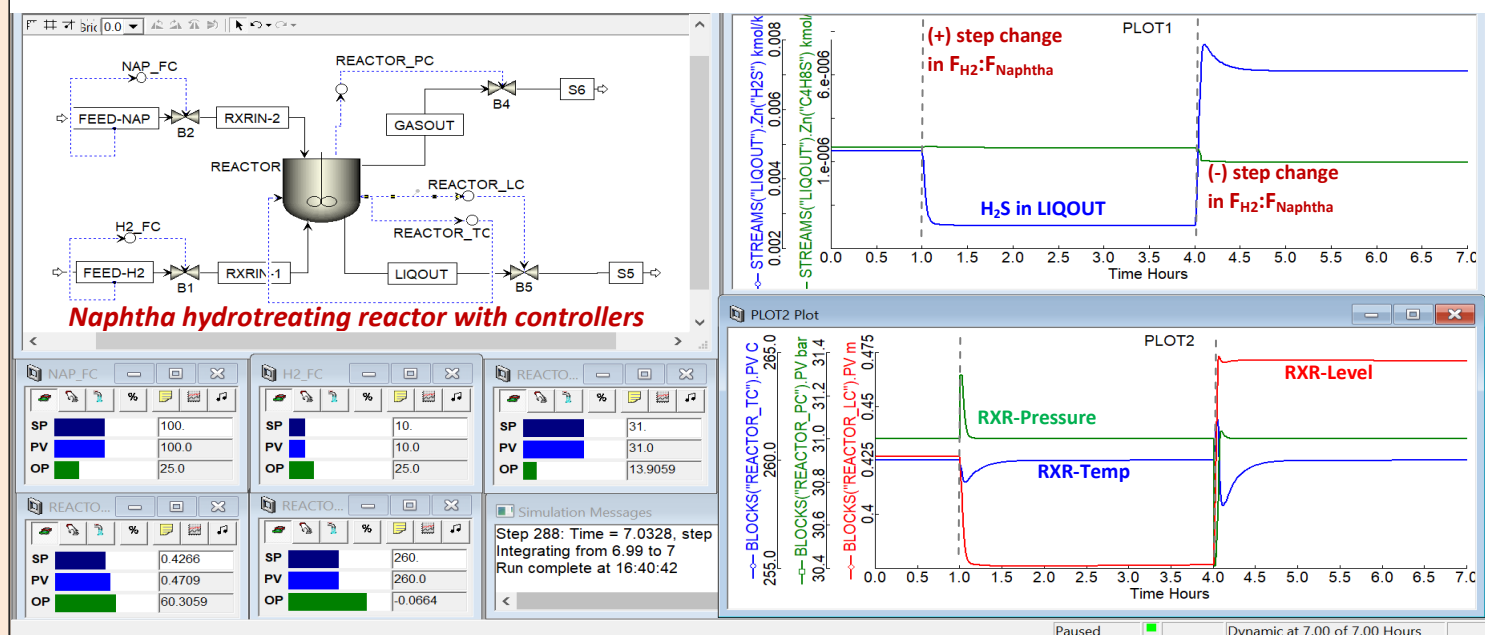
Reported benefits from Process Dynamic Simulations in industries are:

- Easy to understand depictions of transient behavior
- Know-how on improving plant operability towards maximum throughput
- Help in troubleshooting for process upsets by finding cause-effect correlations
- Provision of clear insight on the reduction of project risks with minimum investment

Typical challenges where CSIR-IIP can assist process industries/refineries

- 1. Flare load mitigation studies:** Estimating the highest possible load from PSV relief systems from several operating scenarios like a blocked outlet, inadvertent valve opening, check-valve malfunctioning, electrical failure, exchanger tube rupture, cooling water failure, instrument air failure, steam failure, fuel oil/gas failure, nitrogen failure scenarios.
- 2. Control structure evaluation for feed throughput change:** Appropriate pairing of CVs & MVs using techniques like sensitivity analysis & Singular Value Decomposition. This analysis leads to a better control structure for safe and economic process operations.
- 3. Control structure evaluation for feed composition change**
- 4. Studying controlled depressurization of units:** Identifying the worst-case scenario amongst (a) Power failure, (b) gas/utility failure, (c) Reaction runaway (d) Major leak in reactor furnace and (e) Emergency shutdown
- 5. Possibilities for utility loads optimization in different operating scenarios**

An example of dynamic simulation for a naphtha hydrotreating reactor



- An example shows the transient response for (\pm) step-change in H₂ to Naphtha feed ratio.
- Presented results depict the behaviour of dissolved H₂S in LIQ-OUT and Rxr-Level with disturbance.

We believe our capabilities can serve you well and request a meeting with your technical team to help us understand the specific problems you may be facing. We offer a performance contracting model option where, for a low initial fee and recurring percentage of long-term benefits realized, client financial outlay is minimized unless results justify the expense.

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