

AI-Driven Process Optimization and Risk Management in Chemical Industries

Industrial processes are becoming increasingly complex and require continuous monitoring, optimization, and rapid decision-making to ensure operational efficiency, safety, and reliability. Traditional physics-based simulations such as CFD and multiphysics models provide accurate insights but are often computationally intensive and not suitable for real-time applications. On the other hand, purely data-driven AI models lack physical interpretability and may produce unreliable predictions outside the trained dataset. As a result, industries face challenges in real-time process optimization, early failure prediction, and proactive decision support. To address these challenges, **fluidyn** introduces a real-time Hybrid Digital Twin for industrial processes, combining AI surrogate models with Physics-Informed Neural Networks (PINNs) to deliver fast, reliable simulations, enabling predictive maintenance and continuous performance optimization.



This enables industries to:

- Visualize live 3D flow behavior inside process equipment (Reactors, boilers, compressors, heat exchangers etc..)
- Receive real-time AI-driven recommendations on optimal operating parameters for maximum efficiency
- Predict potential failures in advance, enabling proactive maintenance
- Perform offline analysis to determine optimal operating conditions for feed or process change

Hybrid Digital Twin Approach

Building on this concept, Fluidyn develops a Hybrid Digital Twin architecture that integrates physics-based simulation, machine learning, and real-time sensor data to model and predict the behavior of complex industrial processes.

The framework:

- **Integrates live operational data** from sensors (pressure, temperature, RPM, flow rate, vibration, etc.)
- **Leverages high-fidelity simulation data** generated through Computational Fluid Dynamics (CFD)
- **Trains AI surrogate models using PINNs** for fast and physics-consistent predictions

By enabling real-time estimation of internal system states and equipment performance, this approach transforms industrial operations—driving faster decisions, predictive maintenance, improved reliability, reduced downtime, and truly data-driven optimization. Get in touch with our experts to explore the technology..

Fluidyn exhibits at *International Exhibition On Chemical Processing Technology, Equipment & supplies - 2026*

29-30th April 2026

Hall 2,3,4 & 6, Bombay Exhibition Centre, Mumbai

Fluidyn will be showcasing its latest innovations at the International Exhibition on Chemical Processing Technology, Equipment & Supplies on 29–30 April 2026 at the Bombay Exhibition Centre, Mumbai.

- Visit us and engage with our experts to explore our advanced CFD and multiphysics software solutions for industrial applications.
- Discover how high-fidelity simulations can enhance process design, efficiency, and performance.



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