Steady-state simulations provide powerful, insights into the plant behavior that can be used to enhance designs, safety and operations of process facilities while minimizing capital and operating costs. Aspen Engineering Suite™ (AES) Simulation & Optimization – Steady-State provides a complete set of tools to enable users to quickly create steady-state models for their processes.

The Challenge: Competing in a Challenging Environment

The process industries are faced with an increasingly competitive environment, ever-changing market conditions, and government regulations; yet they still must increase productivity and profitability. These business objectives can be achieved by reducing the time required to get new products to market, increasing the quantity and quality of production and designing plants for an optimum performance along their lifecycle while minimizing the risk of rework. In addition, reliable and trouble-free operation is critical to maximize impact on margins.

There are many barriers to achieving optimal business performance, including reduced engineering staff, processes that are more tightly integrated than ever and plants that are being operated at or above design capacity.

The Opportunity: Linking Business Objectives to Process Designs

Steady-state plant simulation is a powerful tool that helps engineers create optimal process designs based on critical business objectives, thus enabling true Process Lifecycle Management™ (PLM). Major business benefits of steady-state simulation include:

• More efficient and profitable designs. Quickly evaluate process alternatives to identify the most efficient and profitable designs.
• Ensure environmental compliance. Help ensure that process designs meet all environment regulations in a variety of extreme operating cases.
• Achieve consistent product quality. Ensure that the process design will produce the desired product quality for a variety of feedstocks.
• Troubleshoot process problems. Evaluate the root cause of process problems to help ensure that corrective actions will be effective.
• Understand before doing. Provide engineers with a safe, cost-effective way to test proposed solutions before implementing them, thus minimizing the risk of rework.
• Eliminate process bottlenecks. Identify the process bottlenecks that can provide the greatest benefit if removed.
• Ensure safety. Predict the consequences of equipment failures, power failures or other process problems and ensure that a plant is designed to safely handle such events.
• Analyze plant operations. To ensure trouble-free operation and to develop performance improvement strategies using ‘what if analysis’.

• Monitor & optimize operations. Use steady-state simulation to monitor plant performance to track performance degradation and suggest corrective action.

• Real-time optimization. Maximize the profitability of the plant performance by optimizing the performance on a real-time basis in an advisory or closed loop manner.

The Solution: AES Simulation & Optimization – Steady-State

AspenTech’s flagship simulation products, Aspen Plus® and HYSYS® enable comprehensive steady-state process modeling to evaluate design and operating scenarios for profitability, safety, and throughput over the lifecycle of the plant.

These products integrate tightly with AspenTech’s dynamic simulation products, Aspen Dynamics® or HYSYS Dynamics®, for the chemical and oil & gas/refining industries, respectively. By linking steady-state and dynamic modeling, fast start-ups, optimum feed switch strategies, detailed unit and plant-wide performance improvements, and optimal safety of the plant, can all be accomplished. Key capabilities and technologies offered by steady-state products include:

• Rigorous library of steady-state models. The steady-state products come with comprehensive and rigorous steady-state models such as for flow mixers, splitters, heat exchangers, pipes, compressors, pressure relief, reactors, etc.

• Incorporate custom models. Models created using Aspen Custom Modeler® (ACM) can be seamlessly used with most steady-state products to create powerful simulations for optimal and accurate decisions.

• Leverage dynamic simulations. Steady-state simulations in either Aspen Plus or HYSYS can be leveraged and transformed into powerful dynamic simulations. Pressure and level controllers are automatically added and can be configured by engineers within the graphical flowsheeting environment.

• Thermodynamics and physical properties. The steady-state products use rigorous and reliable property calculations methods and data to produce highly accurate and consistent results.

• Powerful algorithms. The steady-state products feature state-of-the-art numerical techniques (including equation based and sequential modular) to ensure fast, reliable, and accurate simulation solutions.

• Analysis tools. Quickly generate plots to understand the impact of design and operating conditions on plant throughput, product quality, environmental waste, capital and operating costs by performing what-if case studies.

• Incorporate on-line data. Steady-state products optionally provide a live link to plant data that can be used to update the model to provide the latest information for simulation.

• Data reconciliation and process optimization. Ensure that the model accurately matches current plant performance by reconciling column efficiencies, heat exchanger fouling or reactor catalyst activity to current process data.

• Integration with other engineering tools. Steady-state products are tightly integrated with many other AES products to provide a comprehensive Process Lifecycle Management solution.
• Open environment. Steady-state products were designed to easily incorporate proprietary in-house or third-party technology. These may be created using Microsoft Excel®, Microsoft Visual Basic®, C/C++, FORTRAN or Aspen Custom Modeler. Complete application programming interfaces (APIs) are available to extract simulation data for use in external applications. AspenTech supports industry standards, such as CAPE-OPEN and IK-CAPE. AspenTech is an Associate Member of the CAPE-OPEN Laboratories Network (CO-LaN).

• Importing of custom models. ACM Model Export™ Option enables user models created and compiled in Aspen Custom Modeler to be integrated into Aspen Plus or HYSYS simulations.

Steady-State Products

Aspen Plus enables the steady-state simulation of petrochemical, chemical and pharmaceutical processes, including non-ideal, electrolytic, and solid systems. Mixed solution methodologies can be used to achieve fast calculation and provide full specification flexibility. Leverage modeling investments by scaling from single models to full facility flowsheets.

Aspen Plus Optimizer™ Option can automatically create profit and process optimization and data reconciliation of large-scale Aspen Plus models based on weighted, user-defined objectives. It provides robust convergence for real-time solutions with models complex enough to address true unit economics and supports Web delivery, so plant engineers can maximize profits through continuous process optimization.

Aspen RefSYS™ enables refinery-wide simulation and optimization using an integrated model of the refinery. It enables refiners to make improved economic decisions throughout the refinery, from crude feed to final product blending.

FLARENET™ enables the design, rating and debottlenecking of single and multiple flare and vent systems. It can calculate the minimum sizes for new flare systems or screen alternatives to remove bottlenecks in existing relief networks. FLARENET can also be used to identify dangerous relief scenarios during design phase while demonstrating regulatory compliance of plant flare and vent systems with over pressure and noise regulations.

HYSYS enables the steady-state simulation of oil, gas and refining processes. Use industry-specific unit operation models and powerful tools to optimize operating parameters for feedstock changes. Interactively make decisions by getting immediate responses to assumptions using a high-speed engine with backward calculation capabilities.

HYSYS Crude Module™ Option enables the simulation of crude oil assays and crude columns. It characterizes the hydrocarbon fluid by determining the hypothetical components that make up the oil and predicts their thermophysical and transport properties.

HYSYS Data Rec™ Option enables the reconciliation of live plant data with HYSYS for on-line performance monitoring and optimization applications.
**HYSYS Neural Net™ Option** enables specialized processes or operations that are difficult to simulate using first-principle models to be incorporated into HYSYS by ‘training’ them using actual plant data. Additionally, a neural net can be trained using data from a model from a HYSYS flowsheet. This closely approximates the first-principle model results, but can significantly increase the calculation speed for the simulation.

**HYSYS OLGAS™ Option** incorporates industry-standard multiphase pipeline flow correlations within HYSYS to calculate pressure gradients, liquid holdups, and flow regimes.

**HYSYS Optimizer™ Option** is an advanced algorithm for optimization based on sequential quadratic program (SQP) technology. It provides a tool for both design optimization and online or offline performance monitoring and optimization applications within the plant.

**HYSYS PIPESYS™ Option** enables the accurate modeling of single and multiphase flows to design, debottleneck, and optimize pipeline systems. It can account for pipeline elevation profiles, inline equipment, pipe composition and roughness, and fluid properties.

**HYSYS Tacite™ Option** provides a tool for multiphase flow modeling for onshore, offshore and deep offshore environments. TACITE is a multiphase flow correlation from IFP that is validated by experimental databanks. It consists of steady-state prediction methods for pressure gradient, liquid hold-up and flow regime.

**HYSYS Upstream™ Option** uses industry-proven methodologies to predict the behavior of the production fluid and integrate the reservoir characterization with the process facility simulation. It provides a standard hydraulic data model that integrates standard upstream technology (Black Oil Thermodynamics and PVT Analysis) and applications (such as PIPESIM-NET from alliance partner Schlumberger) into HYSYS.

**SULSIM®** is a sulphur Plant simulator developed by alliance partner Sulphur Experts. It enables gas processors and refiners to design, analyze and troubleshoot the performance for sulphur recovery units (SRU).

**AspenTech: A Tradition of Innovation**

AspenTech’s proven, integrated software and rapid implementation services enhance the efficiency and profitability of process companies. Our engineering software optimizes process designs to maximize lifecycle returns, and our manufacturing/supply chain software harmonizes production, inventory, demand, and delivery to improve operating margins. Together, these offerings create an integrated solution – enterprise operations management (EOM) – that transforms enterprise-wide operating performance.

AspenTech has a long tradition of innovation in steady-state simulation, among them:

- The introduction of process simulation on the PC and the use of Microsoft Windows®.
- The ‘inside-out’ algorithm and the robust equation oriented algorithm to easily and quickly model the most complex distillation or separation towers.
- The introduction of the combined equation-oriented and sequential-modular flowsheet solving techniques for engineering specification flexibility, and fast and robust calculations.
- Expert system guidance and unique ease-of-use software designs that enable engineers to quickly generate results.
- Open interfaces and data models that support integration and automated data exchange with proprietary and third-party software products.
Aspen Engineering Suite (AES)

The Aspen Engineering Suite (AES) is AspenTech’s Process Lifecycle Management (PLM) solution for process facilities. It integrates rigorous engineering models with data throughout the process asset lifecycle, from conceptual engineering through operational performance. By basing decisions on consistent assumptions, information, models, and work processes, businesses can reach informed decisions faster and with greater confidence. AES consists of six integrated product families:

**AES Simulation and Optimization** optimizes plant designs and operations. It enables engineers to assess plant operability, heat and material budgets, safety, and environmental performance. Its steady-state, dynamic, and batch simulation capabilities enable companies to optimize both capital costs and plant operations and its applied physical properties helps to ensure accurate simulation.

**AES Conceptual Engineering** helps create, identify, and select optimal process designs for heat exchanger networks, separation trains, and utilities.

**AES Equipment Design & Rating** aids the design and rating of heat exchangers to maximize performance, minimize capital costs and operating expenses, and improve process controllability.

**AES Economic Evaluation** links the industry’s largest cost database with engineering models to automatically generate accurate project cost estimates from conceptual definition through detailed engineering.

**AES Integrated Engineering** creates a powerful, secure platform for engineering collaboration on front-end engineering design (FEED) packages, data and model creation, and design and operations analysis.

More than 1500 leading companies rely on AES, including Aventis, Bayer, BASF, BP, ChevronTexaco, Dow Chemical, DuPont, ExxonMobil, Fluor, Foster Wheeler, GlaxoSmithKline, Shell, and Total. For more information, please visit www.aspentech.com.