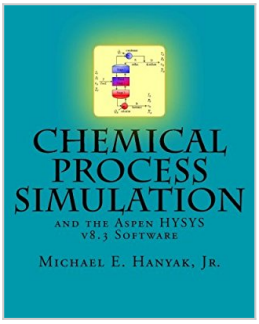

Chemical Process Simulation and the Aspen HYSYS v8.3 Software

By Michael E. Hanyak Jr

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The document Chemical Process Simulation and the Aspen HYSYS v8.3 Software is a self-paced instructional manual that aids students in learning how to use a chemical process simulator and how a process simulator models material balances, phase equilibria, and energy balances for chemical process units. The student learning is driven by the development of the material and energy requirements for a specific chemical process flowsheet. This semester-long, problem-based learning activity is intended to be a student-based independent study, with about two-hour support provided once a week by a student teaching assistant to answer any questions. Chapter 1 of this HYSYS manual provides an overview of the problem assignment to make styrene monomer from toluene and methanol. Chapter 2 presents ten tutorials to introduce the student to the HYSYS simulation software. The first six of these tutorials can be completed in a two-week period for the introductory chemical engineering course. The other four are intended for the senior-level design course. Chapter 3 provides five assignments to develop the student's abilities and confidence to simulate individual process units using HYSYS. These five assignments can be completed over a three-week period. Chapter 4 contains seven assignments to develop the styrene monomer flowsheet. These seven assignments can be completed over a seven-week period. In Chapter 4, each member of a four-, five-, or six-member team begins with the process reactor unit for a specifically-assigned temperature, molar conversion, and yield. Subsequent assignments increase the complexity of the flowsheet by adding process units, one by one, until the complete flowsheet with recycle is simulated in HYSYS. The team's objective is to determine the operating temperature for the reactor, such that the net profit is maximized before considering federal taxes. Finally, eleven appendices provide mathematical explanations of how HYSYS does its calculations for various process units—process stream, stream tee, stream mixer, pump, valve, heater/cooler, chemical reactor, two-phase separator, three-phase separator, component splitter, and simple distillation. This HYSYS manual can be used with most textbooks for the introductory course on chemical engineering, like Elementary Principles of Chemical Processes (Felder and Rousseau, 2005), Basic Principles and Calculations in Chemical Engineering (Himmelblau and Riggs, 2004), or Introduction to Chemical Processes: Principles, Analysis, Synthesis (Murphy,

2007). It can also be used as a refresher for chemical engineering seniors in their process engineering design course. Because the HYSYS manuscript was compiled using Adobe Acrobat®, it contains many web links. Using a supplied web address and Acrobat Reader®, students can electronically access the web links that appear in many of the chapters. These web links access Aspen HYSYS®, Acrobat PDF®, Microsoft Word®, and Microsoft Excel® files that appear in many of chapters. Students can view but not copy or print the electronic version of the HYSYS manual.

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Chemical Process Simulation and the Aspen HYSYS v8.3 Software By Michael E. Hanyak Jr Bibliography

- Rank: #2001389 in Books
- Published on: 2013-11-28
- Original language: English

- Dimensions: 10.00" h x .66" w x 8.00" l,
- Binding: Paperback
- 290 pages

Editorial Review

About the Author
Michael E. Hanyak, Jr. is Professor Emeritus of Chemical Engineering at Bucknell University in Lewisburg, PA. He received his B.S. from The Pennsylvania State University in 1966, M.S. from Carnegie Mellon in 1968, and his Ph.D. in Chemical Engineering from the University of Pennsylvania in 1976. From 1967-1970, he worked as a senior chemical engineer at Air Products, Inc. in Allentown, PA, where he developed process simulation software for cryogenic systems. He served as Professor of Chemical Engineering at Bucknell University from 1974 to 2010. His teaching and research interests included computer-aided engineering and design, instructional design, pedagogical software tools, and the electronic classroom. With undergraduate and M.S. graduate students, he has developed a thermodynamic software system (BUTS), a linear equation system solver (BLESS), a formative assessment system for teamwork (TEAM 360), and an electronic learning system for engineering problem solving (eLEAPS), of which the last three are an integral part of the freshman introductory course and senior design course in Bucknell's curriculum for chemical engineering majors. His two manuscripts—Companion in Chemical Engineering (CinChE): An Instructional Supplement—and—Chemical Process Simulation and the Aspen HYSYS Software—support a team-oriented and problem-based-learning environment for the introductory course in chemical engineering. The CinChE manual presents a novel application of a problem solving strategy that enhances students' higher-order thinking skills of analysis, synthesis, and evaluation. The HYSYS manual is a self-paced instructional document that teaches students how to use effectively a chemical process simulator. For his love of teaching and non-traditional research in support of that teaching, he received the Lindback Award for Distinguished Teaching from Bucknell University in 2002. He has been a member of the American Institute of Chemical Engineers and the American Society for Engineering Education (ASEE). He is the recipient of the 2011 CACHE Award given by the Chemical Engineering Division of ASEE for significant contributions in the development of computer aids for chemical engineering education.

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