PolyMath Software Review

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An extremely practical and high quality book (and software package) for all chemical engineers. HIGHLY RECOMMENDED.

By Umesh Mathuron October 22, 2017
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Professors Cutlip and Shacham, two of the most highly regarded and experienced in the field of chemical engineering computing, have authored this outstanding guide to solving a wide variety of problems in chemical engineering. This book describes succinctly the following classes of problems: (1) fluid properties and other basic calculations such as bubble and dew points, adiabatic flame temperatures, unsteady mixing, and heat exchange in a series of tanks, (2) linear and non-linear regression and correlation of data (a perennial headache), (3) problem solving with Excel and MATLAB, (4) advanced techniques for simultaneous nonlinear algebraic and differential equations (including boundary conditions), and partial differential equations, (5) equations of state for thermodynamic properties, activity coefficient models for nonideal liquid mixtures, and complex chemical equilibria, (6) fluid mechanics of laminar and turbulent flow in pipelines and networks, and other topics, (7) heat transfer by conduction, convection, and radiation, (8) mass transfer in beds and catalysts, simultaneous diffusion and reaction, and simultaneous heat and mass transfer, (9) reaction engineering (batch, plug flow, and CSTRs), (11) phase equilibria and distillation (batch and continuous), (12) process dynamics and control, including process model identification (1st and 2nd order SISO models), tuning methods including Ziegler-Nichols, and PI control, (13) selected topics in biochemical engineering.

As is readily seen, this is a quite comprehensive list of topics in the undergraduate curriculum. The great thing about this book is that it describes, with examples, the use an excellent software package called POLYMATH which was developed by the authors for solving all the problems listed above. A student version - with some limits on problem size, and a professional version - with far wider limits - at a higher but still very modest price, are available at a nominal cost over the web. I have used the professional version of POLYMATH in my own work for several years with excellent success. The algorithms in the software package are of superior quality and have shown excellent convergence characteristics for a wide variety of tests that I have conducted for many of the problem types described above. The syntax is extremely easy to learn, when compared to many other packages, and is implemented in a very straightforward manner. Plenty of example problems are included with the software, so learning to adapt the package to solve your problem should be quite straightforward.

It is worth noting that AIChE's famous list of ten problems was solved very readily using POLYMATH. This is described in the paper "A COLLECTION OF TEN NUMERICAL PROBLEMS IN CHEMICAL ENGINEERING SOLVED BY VARIOUS MATHEMATICAL SOFTWARE PACKAGES", easily accessed on the internet.

For chemical engineering undergraduate (and even graduate) students, I think this is a truly outstanding approach to learning how to formulate and solve a large proportion of standard problems encountered in the typical curriculum. I think that instructors would find this an invaluable teaching tool.

I am a chemical engineer with 51 years of experience and have been active in math modeling, simulation, and numerical methods throughout. In my opinion, this book and the associated POLYMATH software should occupy a prominent place on every chemical engineer's desk. If you want a straightforward and easy-to-learn (but powerful) software package, this is an excellent choice to get started. The book is a highly readable and practical way to understand the use of the software, and contains valuable information on how things work inside. HIGHLY RECOMMENDED.