

SOFTWARE FOR FOOD ENGINEERING APPLICATIONS

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Summary

Currently, there are industry standard flowsheeting and design programs available, which are widely used by chemical engineers. However, existing programs for food processing applications are limited in their ability to handle the wide variety of processes and products encountered in the food industry. The scientific impediments involved consist of a lack of knowledge of relationships between physicochemical and sensory properties, complexity of food components, their chemical/biomedical behavior, and intricacy of on-line measurement of product properties. A main problem lies in the fact that most of the changes are irreversible.

The food engineer deals with computers in one of two ways: 1) understanding how to use commercial software that usually performs well and has a forthcoming interface making it user-friendly and 2) understanding how to develop software that can solve specific problems, because many calculations found in one's professional career will be unique.

Nowadays, a great deal of more or less general-purpose software exists that could be useful in Food Engineering, the main drawback in most cases being the calculation of physical properties. The web appears to be a large source of software for both professional and academic use, due to rapid changes in the field and the kind of information sought. Internet addresses are listed as software sources enabling one to find information about the software indicated in this article, this being the best and most updated Bibliography.

1. Introduction

Food Engineering applications and development have been transformed by revolutionary advances in computer technology, molecular biology, and material science in the past two decades. Computers are increasingly being used for development of material science as well as for analysis, simulation, and control of food processes (see *Food Plant Design*). Computer applications in Food Engineering will continue to grow rapidly, with progress in sensor technology and artificial intelligence. This will enable progress in fields that are limited by the shortage of reliable on-line measurements of product quality. Several critical obstacles must be overcome by these new technologies; the scientific impediments consist of a lack in knowledge of relations between physicochemical and sensory properties, complexity of food components and their chemical reactions, and intricacy in on-line measurement of product properties.

There is a need to link food science research with food engineering and process technologies in such a way as to facilitate an increase in product development efficiency and an improvement in product quality and value. One way would be to research the area of computer-aided process design. Currently, industry standard flowsheeting and design programs are widely used by chemical engineers. However, existing programs for food processing applications are limited in their ability to handle the wide variety of processes and products encountered in the food industry. A program designed specifically for the food industry would diminish turn-around time in preliminary design and analysis of processes. Due to food complexity and the heterogeneity of the attributes (microbiological, chemical, biochemical, sensorial), the results are still scarce, despite the efforts undertaken (see *Engineering Properties of Foods*).

The engineer should know how to work with commercial software because it is universally used, performs well, and has a forthcoming interface making it user-friendly. However, the engineer must also know how to develop software to solve specific problems, because many of the calculations found in one's professional career will be unique.

2. Software Sources

Nowadays, internet usage brings not only a lot of information to the user but also a whole body of freeware that could be very useful. Due to the fact that evolution of the field is fast, it is helpful to know the location of internet sources, thus providing an easy way to update.

Below are listed some internet addresses, where it is possible to find interesting software. It should be noted that there are few sites for Food Engineering. Nevertheless, the more developed field of Chemical Engineering offers many related sites.

- www.upv.es/dtalim/herraweb.htm. The use of computers in Food Engineering is a must today. The rapidly growing field of computing requires a means and a knowledge that is usually not available to single research groups. In order to attain levels of competence according to the highest standard, a cooperative framework was set up in Ibero-America. Seven countries that included Spain, Portugal, Mexico,

Cuba, Brazil, Argentina, and Chile participated in this endeavor. The aim was to address topics of interest for both industry and academia, in order to foster the development of the participating countries and the Ibero-American community in general. So far, nine seminars have been held and eight volumes tackling different subjects and their corresponding computer programs have been produced. The contributions are available at website: <http://www.upv.es/dtalim/herraweb.htm>, where users can easily download the text and the programs. For each topic, an introduction with the relevant theoretical background is provided along with the computer program structure and examples for use of the program.

- www.unicamp.br/fea/ortega/info/curso/library.htm. The objective is to provide Food Engineers with the software to calculate the process and equipment in food industries. The software is updated often.
- www.cheresources.com/software.shtml. Chemical Engineering Software.
- www.chempute.com. On this site, a range of software to cover Chemical, Mechanical, Electrical, and Instrumentation Engineering disciplines can be found, as well as providing selected software in the fields of Cost Estimating, Risk Analysis, CAD (Plant design), and Statistical Process Control.
- www.gulfpub.com/soft. This offers engineering software programs developed by people working in their particular fields of expertise and reflects real world calculation and solution models in use on a daily basis worldwide.
- www.capec.kt.dtu.dk/eurecha/software. The European Committee for Computers in Chemical Engineering Education (EURECHA).
- www.che.ufl.edu/WWW-CHE/topics/modeling.html. Process modeling information resources relevant to chemical and process engineering.
- www.askache.com/AskaChEp.htm. Links to chemical engineering software.
- www.engineering-software.com. Website offers quality engineering software to engineers so they can be more productive in their jobs.
- www.engsoftwarecenter.com. Website is dedicated to the engineering communities and specializes in engineering software.
- www.engcen.com/software.htm. Links to engineering software can be found here.
- www.1stsciencesoftware.com. 1st Science Software is a source for chemical, scientific, statistical, earth sciences, and engineering software.
- www.familiataboada.com/IQ. Free Software for Chemical Engineering.
- www.deb.uminho.pt/fontes/chem_eng/default.htm. Information source is a compilation of useful Internet links for Chemical Engineering.
- www.familiataboada.com/IQ/. This page enables one to find free software for Chemical Engineering applications.

3. Software Tools

Although not specific for Food Engineering, there are many general purpose, software packages that could be useful for Food Engineers. The software found in the market deals with oriented languages directed towards solving general mathematical problems or data treatment: of course, the user should program its particular application. Among the general-purpose software types, Matlab is gaining a reputation for adeptness and has already appeared in Food Engineering books.

3.1. General Software

- Spreadsheet. This is a very useful calculation tool; it allows the computer user to arrange numerical data in rows and columns that intersect to form cells. Computer users can introduce numerical data, text, and formulas in cells. Spreadsheets can store, manipulate, calculate, and analyze data located in the cells. Spreadsheet calculations are determined by formulas placed in the cells by the spreadsheet user. The Spreadsheet components provide formulas, totals, and sorting and filtering functionality. Updated spreadsheets incorporate applications to facilitate data analysis, and improve data handling and results performance.
- Mathematical Languages:
 - MATHCAD, from Chempute Software, is a unified calculation program that includes symbolic and numerical functions.
 - MatLab, from The Matworks, Inc., is a numerical and graphical calculation tool for the engineer and scientist. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation.
 - Derive, from Soft Warehouse, is a symbolic calculation software with the following possibilities in arithmetic, algebra, graphics 2D & 3D, calculus, vectors and matrices, functions, and program (C, Fortran, Pascal, and Basic).
 - Mathematica, from Wolfram Research, is a specialized tool in numerical analysis and symbolic calculations.
 - Maple, from Waterloo Maple, Inc., is a computation system that works in a symbolical or algebraic way.
 - Ansys, from Ansys, Inc., is software to enable the design and solution of problems related to elasticity, fluids, magnetism, and thermodynamics by finite elements.
- Data Treatment Tools:
 - Statgraphics, from Statistical Graphics Corp., is a full-featured statistical package. It includes exploratory data analysis, histograms, box-and-whisker plots, one sample analysis, two-sample comparisons, regression and multiple regression, analysis of variance, and sample size selection.
 - SPSS, from SPSS, Inc., can gather nearly any type of data and use it to generate tabular reports, graphics, and diagrams of distributions and tendencies, descriptive statistics, and complex statistical analysis.
 - BMDP is an integrated system of programs that provides convenient procedures for data analysis, ranging from simple data display and descriptive statistics to advanced multivariate statistical analyses. BMDP is a robust statistical package that has been written to run with less-than-perfect data. It will handle missing data, outliers, and non-normal information. BMDP was recently acquired by SPSS. It appears that SPSS does not intend to update BMDP, and that by itself BMDP is now a dead product.

- Sigma-Plot for Windows, from SPSS Science. Fast graph creation starts with SigmaPlot's award-winning interface. Take advantage of the industry-standard menu design, menu toolbars, right mouse button support, and graph preferences.
 - SigmaStat, from Systat Software Inc., is designed for researchers who need a statistical consultant to help minimize risks. It is Microsoft Office compatible and also works with SigmaPlot.
 - Origin for Windows, from OriginLab Corporation, is an advanced scientific graphing and has data analysis software that is fast, flexible, and user-friendly. Origin provides cutting edge data analysis and graphing tools within an intuitive interface.
- Design tools:
- Autocad, from Autodesk, Inc. Software for drawing and professional design for PC. It can design in two and three dimensions.
 - Imagineer Technical, from Intergraph Corporation, is a tool for drawing and design in two dimensions. It covers the breach existing between the CAD software complex and conventional drawing packages.
 - RFFlow, from RFF Electronics, is a program for creating a wide variety of flowcharts, organization charts, and diagrams.

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TO ACCESS ALL THE 17 PAGES OF THIS CHAPTER,
Visit: <http://www.eolss.net/Eolss-sampleAllChapter.aspx>

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Biographical Sketch

José Bon is Professor at the Food Technology Department, Polytechnic University of Valencia, Spain. José Bon's research and teaching interest are focused on food drying, process simulation, control and ultrasonic application in food processes. He is co-editor of *Herramientas de Cálculo en Ingeniería de Alimentos*, a project of high impact within Ibero-America. So far, nine seminars have been held, and eight volumes tackling different subjects and their corresponding computer programs have been produced. The use of computers in education is one of the main topics addressed in this project.