ATA ÖNAL[1], SEMİH ÖTLES[2]

[1]Department of Computer Engineering
[2]Department of Food Engineering
 Ege University Bornova, Izmir, Turkey

ENGINEERING SOFTWARES USED IN THE FOOD ENGINEERING EDUCATION

Summary. The aim of the presented article is to present some selected personal-computer softwares used in the food engineering. These selected programs are friendly for the use by students but also enough professional to be usable for practical tasks in food technology.

Key words: food, engineering, software, processing, technology

Introduction

Food engineering is the application of engineering, science and technology to the processing, manufacture, production, new product development, evaluation, distribution and packaging of food products. It integrates and applies knowledge within the disciplines of chemistry, engineering, biology, and nutrition to preserve, process, package, and distribute foods that are nutritious, wholesome, affordable, desirable, and safe to eat.

Food Engineering students have training in basic sciences such as mathematics, physics, organic chemistry, inorganic chemistry, analytical chemistry, biochemistry, microbiology, etc. They also study the computer science in food engineering, the chemical composition of food and food ingredients; their physical, biological and biochemical properties; the microbiology of foods; and the interaction of food constituents with each other and their environment.

Software has a critical role in all aspects of the development cycle from discovery from diffusion. Basic studies are affected by software, as literature searches, database inquiries, and inter-student exchanges are usually performed through software. Software, therefore, determines the data students get and the questions they ask. Product developments and designs are greatly influenced by software such as CAD/CAM, and

software can play an especially important role when physical experiments for food engineering students are dangerous or impossible. The aim of this paper is to show the importance of software for food engineering students and also for chemical engineering students.

Education & Processes & Softwares

The use of software in food engineering education focuses on the application and adaptation of processes and technologies in food industry to the classroom. A typical food engineering course consists of a series of lectures along with a small associated class project, but it is insufficient, on its own, to effectively communicate the complex, fundamental dynamics underlying real-world food engineering processes.

Engineering software used in food engineering processes introduces and lays out plans for a detailed, graphical, fully interactive educational food engineering simulation environment that teaches the processes in a practical manner without the time and scope constraints of an actual class project. In order to make simulation a successful educational tool, this engineering software must be based on an appropriate economic model, must consist of the correct "fundamental procedures" of food engineering, and must encode them quantitatively into accurate mathematical relationships, thereby correctly embodying and portraying all of the various factors, dynamics, and cause-and-effect relationships present in the food engineering processes. It should combine high quality modelling and visualization with powerful methods to analyse and predict the properties and behaviour of biological and chemical systems. These powerful methods should include molecular mechanics, quantum mechanics, mesoscale modeling, instrument simulation, etc., and statistical correlations. Table 1 contains the name, web-addresses and short informations of some process softwares used in food engineering education.

Table 1. Engineering Software for Food Engineering Education

Engineering Process Tools http://www.processassociates.com/process/tools.htm	Unique collection of online and free engineering and scientific tools/calculation aids	Free software (online), user friendly, useful for education purposes*
GTT's Technical Thermo-chemistry Web Page http://gttserv.lth.rwth-aachen.de/~sp/tt/	Source of information on the application of technical thermochemistry. Focuses on software (Chem-Sage, ChemApp, and ChemSage-Teach)	Sale software (demo possible), user friendly, useful for education purposes*
NASA Glenn Equilibrium Program (CEA) http://www.grc.nasa.gov/WWW/CEAWeb	Computer program for calculation of complex chemical equilibrium compositions; applications include properties for assigned thermodynamic states, rocket performance, thermal transport properties, thermodynamic properties, Chapman-Jouguet detonations, and shock wave calculations	Free software, user friendly, useful for education purposes*

Free Online Applications for Engineering Design http://www.freecalc.com	Interactive online engineering applications to assist you in designing, constructing, and maintaining your facility; current categories: Liquid & Gas Flow, Pumps, Heat Transfer, Vessels & Tanks, Valve & Piping, Civil/Structural	Free software (online), user friendly, useful for education purposes*
Prode http://www.prode.com/	Software for chemical engineering and process industries, PPP integrates with Microsoft Excel, Visual Basic, and Lotus 1-23 for quick and rigorous process simulation, PD-Plus is a low cost simulator for petrochemical processes	Sale softwares, useful for education purposes*
Computational Dynamics Ltd. http://www.cd.co.uk	Software for calculations for heat exchange, chemical processes, stirred tanks, mixing vessels, static mixers, and cyclones	software (online), useful for education purposes*
CACHE Corporation (Computer Aids for Chemical Engineering http://www.che.utexas.edu /cache/	A not-for-profit organization whose purpose is to promote cooperation among universities, industry and government in the development and distribution of computer-related and/or technology-based educational aids for the chemical engineering profession	Free software (online), user friendly, useful for education purposes*
ChemicaLogic Corporation http://www.chemicalogic. com/	Thermodynamic Properties of Steam, moist Air, CO_2 can be calculated with given software tools and excel add-ons	Sale softwares (demo possible), user friendly, useful for education purposes*
C&R Technologies http://www.crtech.com	Products and services in the areas of heat transfer and fluid system design and analysis	Sale software, user friendly, useful for education purposes*
Astron International Inc. http://www.astroninc.com	Custom software development	Sale softwares, useful for education purposes*
MultiSimplex http://www.grabitech.com	Software for experimental design and optimization, with sequential design of experiments to optimize products, processes, and chemical analytical methods	Sale software (demo possible), user friendly, useful for education purposes*
Ask a Chemical Engineer http://www.askache.com/ AskaChEp.htm#thermo&c hemical%20soft.	Features a large list of Links to software related to ChE	Sale softwares (demo possible), user friendly, useful for education purposes*
Control Station http://www.controlstation. com	Software for process dynamic modeling and simulation, PID controller tuning, and practitioner training	Sale softwares (demo possible), user friendly, useful for education purposes*
G&P Engineering Software: Chemical Engineering, Physical Properties, Property Estimation http://gpengineeringsoft. com	Chemical physical property data base and property estimation tool	Sale softwares (demo possible), user friendly, useful for education purposes*
Process Ace Software http://www.processacesoft ware.com	Palm OS hand-held computer software for Process & Mechanical Engineers. Titles include Gas Fired Heater Calculations, Process Ace Steam Properties, Pump Calculations and Steam Turbine Calculations	Sale softwares (demo possible), user friendly, useful for education purposes*

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QMC http://www.qmc.net	Offers a wide range of programs for analysis and simulation of equipment and process plants; ranging from data mining, engineering, data reconciliation, equipment design to dynamic simulation; detailed description of programs and various papers on simulation and analysis topics	Free and sale softwares, user friendly, useful for education purposes*
FEMLAB – Chemical Engineering Module http://www.femlab.com/chem	The module provides tailored interfaces for MATLAB for problems involving momentum, mass and heat transport coupled with chemical reactions	Sale softwares, useful for education purposes*
ChemEng Software Design http://www.cesd.com/	Offers a number of chemical and mathematical programs including property calculations, simple process simulation and a equation solver	Sale softwares (demo possible), user friendly, useful for education purposes*
Chempute Software http://www.chempute.com/main.htm#CHEMICAL%20ENGINEERING	For Pipe Stress Analysis, Pressure Vessel Design, Process Flowsheet Simulation and Cost Estimating	Sale softwares, user friendly, useful for education purposes*
TDS Web Site http://www.tds-tds.com	TDS has information services and software products for chemical, health and safety and environmental engineers	Sale softwares, useful for education purposes*
OLI systems Inc. http://www.olisystems.com/	Provides process simulation tools for oil fields, wastewater treatment, chemical processing plant operation and optimization, reactive separations, and environmental simulations; extensive database of aqueous electrolyte chemistry	Sale software (demo possible), user friendly, useful for education purposes*
Kintecus Homepage http://www.kintecus.com	Modeling software to simulate the chemical kinetics of combustion, nuclear enzymatic, catalyst-reactor and many other chemical reactions	Free software, user friendly, useful for education purposes*
Katmar Software http://www.katmarsoftware.com	Shareware programs for properties of ice, water and steam; packed column hydraulics; project risk analysis	Free software, user friendly, useful for education purposes*
ChemiSoft http://www.chemisoft.com	A Community on the Internet for Chemical Engineers (Development of Software, Computational Fluid Dynamics, Numerical Analysis, Computer Programming	Free software, user friendly, useful for education purposes*
Tencon Software Solutions http://www.tencon.nl	Software for calculating properties of water & steam, unit connversion, digitising paper graphs and the properties of coolants	Sale software (demo possible), user friendly, useful for education purposes*
Software Tools for Process Integration http://www.technology.novem.nl/process-integration/	List of software tools on Process Integration, and user's experiences with those tools are presented	Sale softwares (demo possible), useful for education purposes*
CAFLUR http://caflur.sourceforge.net	A Chemical Reactor Analysis Tool; it can generate a HTML file with tables and graphics of Residence Time Distributions; it can calculate conversions for both linear and non-linear systems, with and without flow model; and the parameters for some non-ideal flow models (tanks in series, axial dispersion and combined models)	Sale software, useful for education purposes*

FlowPhase Software Inc. http://www.flowphase.com	VLEFlash is a package for performing multicomponent single-stage equilibrium calculations; also offers programs for compressor design, quick pipe sizing and for predicting the fluid phase equilibria in natural gas-water systems, in particular sour natural gas	Sale softwares (demo possible), user friendly, useful for education purposes*
Reliability Safety Software http://www.reliability-safety-software.com	Reliability, Availability, Maintainability and Safety Software	Sale software, useful for education purposes*
Pulmodel Programs http://users.volja.net/pulmodel/index.htm	Computer simulation for pultrusion of composite profiles	Free software, user friendly, useful for education purposes*
Thermal Analysis Systems LLC http://www.cuservices.net/software.htm	A series of twenty-six engineering programs for the engineer who specifies, operates, or tests power plant components or process equipment or evaluates energy alternatives; includes heat transfer, fluid flow and rotating equipment	Sale softwares, useful for education purposes*
Chemb Consulting & Environmental http://chemb.com.au/	Provides comprehensive process engineering and consulting services throughout the chemical-process industry; distribution of engineering and scientific software products specialising in process simulation and modelling, equipment design and statistical process analysis	Free softwares, useful for education purposes*
e-fficiency https://www.amsperformancemonitor.com/	Web-based Plant Equipment Performance Monitoring of Gas Turbines, Steam Turbines, Compressors and other Turbo and Rotating Machinery	Sale software, useful for education purposes*
Korf Hydraulics http://www.korf.co.uk	Fluid flow calculations for process industry; description of program abilities and screenshots	Sale softwares (demo possible), user friendly, useful for education purposes*
HeatHit http://www.raczynski.com/pn/heathit.htm	A 3D heat transfer simulation program for arbitrary body shapes	Free software, user friendly, useful for education purposes*
Softbits Consultants http://www.softbits.co.uk/	Supplies Flaresim, a process simulation and analysis program for the design of flare systems in the offshore oil and gas industry; they also provide consultancy services	Sale software, useful for education purposes*
Combustion Emission Simulation Software http://www.geocities.com/combusem/COMBUSEM.HTM	COMBUSEM allows the user to determine the emission impact of several combustion units, such as boilers, and furnaces; the software also performs atmospheric dispersion analysis of the effluent gas	Sale software (demo possible), user friendly, useful for education purposes*
DataPro http://www.cesd.com/datapage.htm	Chemical compound information and estimation of chemical compound data; includes Periodic Table, physical and thermodynamic data	Sale software (demo possible), user friendly, useful for education purposes*

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Intelligent Optimization Group http://intellopt.com	Specializes in advanced process control, multivariable predictive control, real-time optimization, expert systems and neural networks for the refining and chemical processes, completed and available training courses	Sale software (demo possible), useful for education purposes*
Kinematrix Software http://www.kinematrix.com	Providing chemical engineering software solutions to everyday engineering needs	Sale software (demo possible), user friendly, useful for education purposes*
Cheminform St-Petersburg (CISP) Ltd. http://www.cisp.spb.ru/	Methodology and software for experimental data processing, kinetics evaluation and reactor simulation; description of software and company, with list of references; downloads of software and manuals	Free software, user friendly, useful for education purposes*
AQUAlibrium http://www.telusplanet.net /public/jcarroll/AQUA. HTM	A software package for predicting the fluid phase equilibria in natural gas-water systems, in particular sour natural gas	Sale software (demo possible), user friendly, useful for education purposes*
ControlSim – Spreadsheet based simulation of PID controller and process http://www.jashaw.com/ ebooks/simorder.html	ControlSim is a simulation of a PID controller and a simple process model used for training and practice in controller tuning, for purchase and download from site	Sale software (demo possible), useful for education purposes*
Thorn Technologies http://www.thornti.com	Thorn Technologies, along with Simulation Solutions, provide Windows based chemical process simulators integrated with performance analysis tools	Sale software (demo possible), user friendly, useful for education purposes*
Inventech Ltd. http://www.inventech.co. uk	Provides details of software products for process engineers, specialising in the application of vacuum, condensers and thermocompressors to process inductry	Free software, user friendly, useful for education purposes*
CemoS – Chemical exposure model System http://www.usf.uni-osnabrueck.de/projects/ CemoS/CemoS.en.html	A model developed for prediction of fate and distribution of hazardous chemicals released to the environment, from the University of Osnabrück; the model is available for download; a textbook is available for order	Free software, user friendly, useful for education purposes*
Heat Integration http://www.heatintegration. com/index.html	Free Pinch technology software to learn and apply pinch technology to the design of heat exchanger networks	Free software, user friendly, useful for education purposes*
Adaptive Resources http://www.adaptiveresources.com/	Supply advanced regulatory control technology; products include the adaptive model-predictive regulatory controller and a modeling and simulation tool to create process models and predict process behaviour	Sale software, useful for education purposes*
WaveOne http://www.waveone.com	Provides online chemical engineering software including free thermodynamics packages for predicting various states	Sale software, useful for education purposes*
Technical Spreadsheet from Kinematrix http://www.technicalspreadsheet.com/	Chemical engineering specific spreadsheet that allows unit conversion and complex calculations	Sale software (demo possible), useful for education purposes*

Gaseq Chemical Equilibrium Program http://www.c.morley.ukgateway.net/	A free Windows program for combustion related chemical equilibrium calculations: flame temperatures, compositions, shocks and detonations	Free software, user friendly, useful for education purposes*
Sulphuric http://sulphuric.tripod.com/	Engineering package for the design and simulation of plants producing sulphuric acid and related products; capabilities include material and energy balance, temperature and pressure calculations, and optimizing operating parameters	Free software, user friendly, useful for education purposes*
Algor http://www.algor.com/products/Profes1732/default.asp	Fluid flow analysis	Sale software (demo possible), useful for education purposes*
DryInf http://www.geocities.com/thedryinf/	Dryer type selection, incl. waste water treatment; program description and development; download trial version	Sale software (demo possible), useful for education purposes*
PE 2000 for Windows http://www.tu-harburg.de/vt2/pe2000/	Windows program for calculating fluid phase equilibria in systems with up to 10 components and 3 coexisting phases using 45 different equations of state	Free software, user friendly, useful for education purposes*
The Web Page of MTB http://www.geocities.com/manueltb/page8.html	Free Software for the chemical engineering found on the web; only FREEWARE programs	Free software, user friendly, useful for education purposes*
Engineer's Toolbox http://www.tasonline.co.za/toolbox/index.htm	Collection of online calculations which includes pumps, pipelines, area, volume, surface, unit conversion, and material properties	Free software (online), user friendly, useful for education purposes*
Vapor Pressure of Binary Mixture http://www.fortunecity.com/campus/german/207/vpmix.html	Downloadable spreadsheet to help find the vapor pressure of binary liquid mixtures with minimal inputs; the spreadsheet is based on Excel 97; complete with a comprehensive list of Antoine Equation constants needed for the calculations	Free software, user friendly, useful for education purposes*
Xware Automation http://www.xware.nl	Develops technical software specifically for the AC and temperature measurement markets; software offered include Mollier h/x diagram, Steam/water properties, Thermowell calculations, heat gain/loss calculations for buidings and Refrigerant line calculations	Sale software, useful for education purposes*
Deerhaven Technical Software http://www.deerhaventech.com	Information on the PD-PLUS Chemical Process Simulator for steady-state modeling of chemical, petrochemical, and refinery systems	Sale software (demo possible), useful for education purposes*
EFFTech Engineering Software http://www.efftech.eng.br/	Software and simulators for industrial equipment, polymers, quality control, and engineering education	Sale software (demo possible), useful for education purposes*
WWW Virtual Library – Process Modelling http://www.che.ufl.edu//WWW-CHE/topics/modeling.html	Software and other information resources relevant to chemical and process engineering	Free and sale software, useful for education purposes*

Computer Toolbox http://www.eb.uah.edu/che /tools/	A collection of computing tools for chemical engineering calculations; examples include Spreadsheets (MS Excel), Maple V, Aspenplus and ASCEND	Free software, user friendly, useful for education purposes*
Cape Software's VPLink http://www.capesoftware. co.uk	An easy to use simulation package for control testing and operator training needs; VPLink connects to most DCS and PLC systems in place of the real I/O allowing thorough testing of control software before plant start up; the package also provides flexible, low cost operator training simulators	Sale software (demo possible), useful for education purposes*
Alchemy Software http://chemicalsoft.com	Software for the simulation and modeling of chemical mechanisms for use by chemists in research laboratories and by academic institutions	Free and sale software, user friendly, useful for education purposes*
RefModl http://www.refmodl.com	Oil refinery non-linear modeling software program; to calculate capex, yield and financials of: different crudes, new process modules, alternative refinery configurations and revised product specifications; short program description and download information	Sale software, useful for education purposes*
Calculations for equipment sizing and rating for the chemical process industry http://tierling.home.texas. net/	General calculations for chemical and plant engineering; interactive Java applets	Free software, user friendly, useful for education purposes*
The Thermal Wizard http://www.team-eng.com/ tmwiz/	A collection of online routines to calculate common heat transfer problems and thermal phenomena; includes a unit converter and tabelles of property data	Free software (online), user friendly, useful for education purposes*
GE Enter Software – Power Plant Design and Monitoring Software http://www.gepower.com/ enter	Heat balance and thermodynamic software for gas turbine and fossil power plant design, performance monitoring and optimization; products include GateCycle, EfficiencyMap, Plant Payback and the Optimizer	Sale software, useful for education purposes*
Binary Distillation Simulator http://www.geocities.com/ combusem/BDSIM.HTM	BDSIM performs binary distillation calculations to establish the required number of theoretical stages, and columns dimentions (height and diameter); the program presents the resulting McCabe Thiele diagram for the specified separation	Sale software (demo possible), user friendly, useful for education purposes*
DataFit 6.1 http://www.oakdaleengr. com/features.htm	A science and engineering tool that simplifies the tasks of data plotting, regression analysis (curve fitting) and statistical analysis; a 30 day evaluation copy may be downloaded	Sale software (demo possible), user friendly, useful for education purposes*
TANKJKT software http://www.chemengsoftw are.com/tnkintro.htm	Excel spreadsheet template that calculates heat transfer and pressure drop for dimple, half-pipe coil, and conventional jackets; it includes a database of more than 100 heat transfer fluids	Sale software, useful for education purposes*
ERGUN: Fluidized bed design software http://www.utc.fr/ergun/	Ergun is a computer program for modeling and simulation in fluidization with details on grids, bubbling, TDH, cyclones, heat transfer and reaction aspects	Free software, user friendly, useful for education purposes*

HES – Heat Exchanger Simulator http://efftech.tripod.com/hes.htm	Educational software for shell and tube heat exchanger simulations	Sale software (demo possible), user friendly, useful for education purposes*
Chemical and Plant Engineering Calculations http://tierling.home.texas.net/default.htm	Online calculations for equipment sizing and rating for compressor, distillation column, exchanger, pump, and line hydraulic ratings	Free software, user friendly, useful for education purposes*
Combustion Expert http://www.combustionsoftware.com	For designing and optimizing industrial combustion systems. Fuels include natural gas, liquefied petroleum gases, light and heavy oils and coal; software description, FAQ, ordering and download information	Sale software, useful for education purposes*
Fault Tree Analysis Software from IsographDirect http://www.isographdirect.com/index_ft.htm	Professional reliability software from Isograph – fault tree, event tree, weibull, simulation, reliability centered maintenance, life cycle cost, hazop, markov, reliability model	Sale software, useful for education purposes*
Van Mierlo Software Consultancy Product List http://ourworld.compuserve.com/homepages/mierlo/vmsc.htm	Custom built software and a number of ready made products, including DAx Data Analysis software, CA Contact Angle Determination software, Digi-Ball Digitising software, and instrument control packages	Sale software, useful for education purposes*
Process Ace Software http://www.processacesoftware.com/	Process and Mechanical Engineering software for hand-held (Palm OS) computers; these includes centrifugal pump, steam turbine and steam property calculations	Sale software (demo possible), user friendly, useful for education purposes*
VLECalc, shareware for VLE w/ UNIFAC, NRTL http://www.net-link.net/~wdkovats	A shareware tool for chemists and engineers who develop manufacturing processes using organic solvents and chemicals; VLECalc can estimate the vapor pressure and boiling point of an organic mixture using UNIFAC or NRTL activity coefficients; it can simulate a simple batch distillation or solvent replacement operation; Requires EXCEL 97	Free software, user friendly, useful for education purposes*
Estimation of multiple-effect evaporators http://www.caravan.ru/~shuvalan	A program for estimation of both single and multiple-effect evaporators for Windows	Free software, user friendly, useful for education purposes*
Two Phase Flow in Pipes www.processassociates.com/process/fluid/2faz_xy.htm	Easy to use spreadsheet to estimate pressure losses in pipes with two-phase flow	Free software (online), user friendly, useful for education purposes*
Various Chemical Engineering Calculation Spreadsheets www.cheresources.com/software.shtml	Zip file with Excel spreadsheets including calculations such as: unsteady state heat transfer, horizontal vessel calibration data, catenary equations, compressible flow calculations, cone and circle geometry, control valve sizing, dewpoints of acidic gases, duct calculations, orifice sizing, packed scrubber design, flat plate deflections, pump performances, and rectangular weir flow; these spreadsheet provided by Mr. Neil	Free software (online and offline), user friendly, useful for education purposes*

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Filtration Spreadsheets from Dr. Richard Holdich www-staff.lboro.ac.uk/ ~cgrgh	Calculations include specific surface area, compressible cake at constant pressure, compressible cake at constant flow, power law equation, pressure leaf clarification costing, and rotary vacuum filtration; complete with documentation; files are in Excel format, download as a zip file	Free software, user friendly, useful for education purposes*
Vessel Pressure via the SRK Equation of State www.cheresources.com/ software.shtml	Use this Excel spreadsheet to find the pressure inside a vessel via the SRK equation of state (EOS); brought to you by the Direction of Software Corner, Somak Mukherjee	Free software (online and offline), user friendly, useful for education purposes*
Fired Furnace Excess Air Calculation www.cheresources.com/ software.shtml	Calculate the excess air volume required for a hydrocarbon furnace with the Orsat analysis; Excel spreadsheet provided by the Direction of Software Corner, Somak Mukherjee	Free software (online and offline), user friendly, useful for education purposes*
Financial Calculation Spreadsheet www.cheresources.com/ software.shtml	You know what a chore it is to optimize a chemical process and get to the bottom line; then you make some changes and have to do it all over again; here a great spreadsheet that should ease you pain substantially!	Free software (online and offline), user friendly, useful for education purposes*
Water Properties Program www.cheresources.com/ software.shtml	Download this small helper program so that you have the properties of water at your fingertips; the link above is a direct link to the executable file; this program was graciously donated the Resource Page by Pablo Coronel at pcorone@unity.ncsu.edu	Free software (online and offline), user friendly, useful for education purposes*
Physical Properties Data-Bank AddIn for Excel www.cheresources.com/ software.shtml	This Excel AddIn contains a moderate databank of chemicals and a nice array of physical properties; it also contains Excel functions that can be pasted into worksheets (be sure you have one open first); you'll find the AddIn under the Tools menu	Free software (online and offline), user friendly, useful for education purposes*
Units Conversions www.onlineconversion. com	These handy little programs are just about everywhere; there a good and bad side to this one; the bad side is that is runs in DOS, the good side is that it shows many different conversions at once	Free software (online), user friendly, useful for education purposes*
The Reactor Lab www.reactorlab.com	A fantastic program designed to help students gain a better understanding of reactor simulations... and best of all... it's free!	Free software, user friendly, useful for education purposes*
Insulation Calculation Programs www.cheresources.com/ software.shtml	Two programs included to help you with insulation calculations; the "Economic Thickness Calculator" will recommend the appropriate insulation thickness based on energy savings; the "Insulated Pipe Temperature Prediction Spreadsheet" will help you predict the temperature inside a pipe and linear heat loss	Free software (online and offline), user friendly, useful for education purposes*
Vapor Pressure of Binary Liquid Mixtures www.cheresources.com/ vpmix22.shtml	Use this spreadsheet to find the vapor pressure of binary liquid mixtures; based on fugacity corrected values from Antoines Law, this spreadsheet give accurate results with minimal inputs	Free software (online and offline), user friendly, useful for education purposes*
Physical Property Data Spreadsheet www.cheresources.com/ physinternet22.shtml	This spreadsheet for Excel 97 contains data such as boiling and freezing points, critical data, density, vapor and liquid heat capacities, liquid viscosity, vapor pressures, and more for 468 chemicals	Free software (online), user friendly, useful for education purposes*

Cooling Tower Calculator www.cheresources.com/ software.shtml	This handy little DOS program will calculate the tower characteristic or cold water temperature for a given cooling tower with just a few inputs, (see Cooling Tower article here at the "Resource Page")	Free software (online and offline), user friendly, useful for education purposes*
Pipe Size Optimization for Carbon and Stainless Steel Pipes www.cheresources.com/ pipes.xls	This simple spreadsheet will calculate the most economical pipe diameter for a system based on flowrate, fluid density, and fluid viscosity; the sheet is to be used for turbulent flow in carbon or stainless steel pipes; it is designed to run on Excel 97 or higher and utilizes the Solver function so it must be installed as well	Free software (online and offline), user friendly, useful for education purposes*
Validating Binary VLE Data www.cheresources.com/ validating22.shtml	Check the thermodynamic consistency of your binary VLE data with this easy to follow analysis; complete with spreadsheet to save you time!	Free software (online and offline), user friendly, useful for education purposes*
Costing Distillation Columns www.cheresources.com/ qdist22.shtml	Enter some basic data and this EXCEL ADD-IN will do the rest; check out the specifications of the program	Free software (online and offline), user friendly, useful for education purposes*
Vapor-Liquid Equilibrium Calculator www.s-ohe.com	This program uses data stored in its own Excel Spreadsheet to formulate VLE and other thermo-dynamic data by several popular correlations; database of components is expandable so you can add your own components; developed by William D. Kovats	Free software (online), user friendly, useful for education purposes*
ReactOp Standard (Reactor Optimization Standard) www.cisp.spb.ru/html/ces. html	ReactOp Standard (Reactor Optimization Standard) allows ser to estimate rate constants of chemical reactions and simulate behavior of batch, semibatch, stirred tank and plug flow reactors; an important feature of ReactOp Standard: one need not write a line of code to solve these tasks; ReactOp Standard is absolutely free for non-commercial and commercial use; we provide on-line support for all users. Chemical engineering software for professional chemical engineers	Free software, user friendly, useful for education purposes*
ReactOp Pro www.cisp.spb.ru/html/ces. html	ReactOp Pro (Reactor Optimization Pro) allows user to estimate rate constants of chemical reactions and simulate behavior of chemical reactors; to optimize design and operation mode of chemical reactors of different types; to identify reaction mechanisms by experimental data; an important feature: one can implement his own non-standard models of chemical reactors in ReactOp Pro.	Free software, user friendly, useful for education purposes*
ReactOp Cascade www.cisp.spb.ru/html/ces. html	ReactOp Cascade (Reactor Optimization Cascade) has all the features of ReactOp Pro. Additionally, ReactOp Cascade allows user to model and opti-mize operational mode of cascades of chemical reactors	Free software user friendly, useful for education purposes*
CR (Catalytic Reactor) www.cisp.spb.ru/html/ces. html	CR (Catalytic Reactor) allows user to simulate fixed bed heterogeneous catalytic reactors in order to optimize design and performance of the indus-trial and bench-scale reactors, to investigate	Free software, user friendly, useful for education purposes*

	wrong-way behavior of reactors and heat waves, and to locate hot spots; an important feature of CR: it is the possible to deal with multi-component gas or liquid flow and complex chemical reactions	
RTD (Residence Time Distribution) www.cisp.spb.ru/html/ces.html	RTD (Residence Time Distribution) allows user to investigate hydrodynamic flows in chemical apparatuses; an important feature of RTD: it is the possible to design complex schemes of hydrodynamic flows, including recycles, in an interacitve mode	Free software, user friendly, useful for education purposes*
CatKin (Catalytic Kinetics) www.cisp.spb.ru/html/products/products/software/catkin.html	CatKin (Catalytic Kinetics) is an application for deriving expressions of overall rate equations and parameter estimation in complex heterogeneous catalytic reactions; it is a powerful tool that is based on up-to-date numerical methods and Graph theory; an important feature of CatKin: procedure of automation for simplifying kinetic models. Users of our chemical engineering software	Free software, user friendly, useful for education purposes*

*Useful for a series of lessons, eg Material and Energy Balances, Physical Chemistry, Thermodynamics, Fluid Mechanics, Unit Operations, Heat Transfer, Unit Operation Laboratory, Process Control, Food Engineering Design and Economy.

Future Readings

Future readings are more contact for engineering softwares.
http://gams.nist.gov/
http://pubs.acs.org/pin/tripos/tripos.html
http://www.accelrys.com/about/msi.html
http://www.ari.net/ars/
http://www.che.ufl.edu/aspen/
http://www.cheme.cmu.edu/research/capd/
http://www.chemicalogic.com/steamtab/
http://www.dcl.co.il/chemsoft.html
http://www.jandel.com/
http://www.mathsoft.com/
http://www.scitechint.com/
http://www.webcom.com/

SPECJALISTYCZNE OPROGRAMOWANIE KOMPUTEROWE
PRZYDATNE DO NAUCZANIA INŻYNIERII ŻYWNOŚCI

Streszczenie. Celem prezentowanego przeglądu jest wskazanie sprawdzonego oprogramowania komputerowego przydatnego do nauczania inżynierii żywności. W wyborze zwrócono szczególną

uwagę na łatwość posługiwania się oprogramowaniem oraz równocześnie możliwość jego użycia do realizacji praktycznych zadań dla technologii żywności.

Słowa kluczowe: żywność, inżynieria, oprogramowanie, komputery, technologia

Corresponding address – Adres do korespondencji:
Semih Ötles, Department of Food Engineering of Ege University, Bornova 35 100, Izmir, Turkey,
e-mail: sotles@food.ege.edu.tr