Computer Program Manuals

The American Institute of Chemical Engineers has published a series of manuals on computer programs for the chemical process and allied industries. Originating in industry, these programs have been tested and revised by the A.I.Ch.E. Machine Computation Committee. Although written for specific computers, the programs are so complete that they may easily be adapted for other computers.

BUBBLE CAP TRAY DESIGN: calculates the tray hydraulics for bubble trays using the Davies correlation. Other than tray layout no additional input data are required for this program than would be readily available to the engineer. $25. No. 7

SOLUTION OF COUNTERFLOW WATER COOLING TOWER: calculates the return water temperature to the process heat exchangers and other performance conditions with a given characteristic of the active fill of the cooling tower, a given plant energy load, and given water circulation and air throughout the ambient conditions. Where the tower has excessive cooling capacity, the program calculates the amount of hot water that should be bypassed to maintain a specified supply water temperature. $25 No. 6

DISCOUNTED CASH FLOW: The program evaluates the profitability of an investment (or series of investments) by calculating a discount factor which represents the "interest rate" that would have to be earned by the expenditures in order to yield given receipts. The input data consist of a timed list of cash in- and out-flows. Four types of cash flow are acceptable: instantaneous (lump sums), uniform, declining linearly to zero and rising linearly from zero within given time intervals.

The method of solution is by successive approximations and is similar to the one described in J. C. Gregory's "Interest Tables for Determining Rate of Return," The Atlantic Refining Company, Philadelphia, Pennsylvania (1946). Two alternate solutions are available: one based on continuously compounded interest and a second one based on discrete compounding.

The program includes also a "screening" routine for rejecting problems having ambiguous solutions (false, multiple or none). In such cases special information is calculated and punched out for diagnostic purposes. $15 No. 12

PRESSURE DISTRIBUTION IN PIPING NETWORKS: The program calculates flow and pressure distribution in a piping network connecting fixed sources and sinks. The network may consist of loops or radial branches or a combination. Elements of the network may be equivalent lengths of pipe or pumps or other equipment in which the pressure loss or gain is a function of flow. Elevation differences can also be included in the system. Nonplanar networks (having cross-overs) can be handled. The program is limited to problems where the assumption of an incompressible fluid does not introduce appreciable error, although gas problems not involving critical flow can be solved by special handling. The program will handle up to 450 members and any number of loops. The Hardy Cross algorithm and fixed-point arithmetic is used. $25 No. 10

SOLUTION OF THE LIMITED FORM OF THE B-E-T MULTIMOLECULAR ADSORPTION EQUATION: solves the general form of the B-E-T equation determining the number of molecular layers adsorbed which permits direct determination of the constants of the equation, including the adsorbent surfact area. The program has been used successfully to determine the value of the constants of the B-E-T equation for the adsorption of various halogenated gases on alumina, silica gel, and carbon. $25 No. 9

MULTICOMPONENT DISTILLATION: is a multicomponent, tray-by-tray calculation with a heat balance around the column and around each tray. Any one of three results can be obtained: the component distribution in the distillate and underflow for a fixed number of theoretical trays, a fixed feed location, a specified reflux ratio, and fixed draw-off rates; the reflux ratio required to obtain a specified split between key component for a fixed number of trays and a fixed feed location; and the best feed trays. $25 No. 8

COMPLEX-TOWER DISTILLATION: performs a complete plate-to-plate distillation calculation with heat and material balances. Three feeds and five side-stream draw-offs may be handled, and liquid and vapor distillate streams may be specified separately or in combination. A maximum of twenty-one components and one hundred theoretical plates are possible. $25 No. 4

NONLINEAR ESTIMATION: treats the problem of a functional relation between a single dependent variable and a set of independent variables and parameters, the necessary condition being that it admit of numerical evaluation. $25 No. 3

SOLUTION OF PIPING FLEXIBILITY PROBLEMS BY DIGITAL COMPUTER: calculates the movement of a restrained piping system and the stresses produced in each member when heated to operating temperature. Input data form specifies the pipe size, temperatures and pressures, Poisson's ratio, and Young's modulus. $25 No. 5

LINE SIZING: gives calculations necessary to convert the units of flow and density; to size liquid, vapor, or water lines on the basis of a specified maximum pressure drop; and to determine the pressure drop for a given diameter and length of pipe. $25 No. 1

EQUILIBRIUM CONSTANTS FROM THE BENEDICT-WEBB-RUBIN EQUATION OF STATE: This program will calculate the vapor-liquid equilibrium constants for any mixture of methane, ethylene, ethane, propylene, propane, isobutane, isobutylene, normal butane, isopentane, pentane, normal hexane, and normal heptane. It is limited to these twelve components, for which Benedict-Webb-Rubin equation constants are available.

The input data required are temperature, pressure, and the approximate mole fraction of each component in both liquid and vapor. The programs will calculate and print out equilibrium constants for practically any temperature, pressure and combination of mole fractions submitted, whether they have any physical significance or not. $15 No. 15

SELECTIVE CURVE FIT: Given a set of x-y data, this program calculates the coefficients for thirty-six simple, arbitrarily selected empirical equations. Three additional quantities are calculated for each equation to help determine the quality of the fit. $15 No. 14

ORIFICE DESIGN: The program sizes orifices for metering or flow limiting of liquids, gases, or steam. A beta ratio (orifice diameter to pipe diameter) is assumed. The Reynolds number, expansion factor, orifice coefficient, etc., are calculated and compared with the assumed beta ratio. This procedure is automatically repeated by trial and error until the correct beta is found. The orifice bore, size and location of vent hole, position of taps, etc., are then computed. Fluid characteristics, flow conditions, and computing constants must be specified. Three separate edited outputs provide (1) a recapitulation of input data for checking, (2) a report of problem data and calculated results, and (3) dimensions and other data required by a shop for fabrication of the orifice plate. $15 No. 13