COMPUTER SOFTWARE REVIEWS

SteamTab: Thermodynamic and Transport Properties of Steam

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Received August 5, 1996

This calculation package, produced by the ChemicaLogic Corporation,[1] provides a tool for generating the properties of liquid and gaseous water over a wide range of temperature and pressure. The package comes as an add-on to Microsoft Excel or Lotus 1-2-3 and requires these spreadsheet programs for operation. Present versions of SteamTab 1.0 are available for Microsoft Excel V5.0 for Windows 3.1x, Excel V7.0 for Windows 95, and Lotus1-2-3 Release 4.0 or higher for Windows 3.1x. The purchaser must specify the version desired.

Installation is relatively simple; the manual provides exceptionally clear instructions for each of the three spreadsheet options. The program requires 500 kbytes of disk space. A math coprocessor is recommended, but no memory requirements are stated. In tests of the Excel 5.0 version on a 133 MHz Pentium machine with 16 Mbytes of memory, all operations were carried out essentially instantaneously.

After installation, the SteamTab module appears as a listed item on the Tools menu of Excel. When this item is selected, three options are presented for different types of calculations: saturation, superheated/supercooled conditions, and a simple display of the fixed points of water (triple point, critical temperature, and pressure, etc.). Each option has its own screen for entering the independent variable(s) and specifying the property whose value is desired. The result of the calculation appears in the spreadsheet cell designated by the user. This result is not simply the numerical value corresponding to the input data but rather the formula for the specified property. Thus one can copy the output cell to other parts of the spreadsheet and generate tables for any desired range of input variables, without calling up the SteamTab module again. In effect, SteamTab provides a quick and painless way to transfer the extremely complex equations for the thermodynamic and transport properties of water (involving up to 40 terms for each property) to a spreadsheet where the customary mathematical and graphical operations can be carried out.

A total of 21 properties are covered by the program, including entropy, heat capacity, speed of sound, compressibility, viscosity, surface tension, etc. For calculations under saturated conditions, either temperature or pressure can be used as the independent variable. For compressed water and superheated steam, where two variables are required, all combinations of T or P with any one of the variables V, H, S, or E are accommodated. A choice of metric (°C, bar, J/kg, etc.) or English (°F, psia, Btu/lb, etc.) units is offered.

In addition to the modes for calculating the basic properties, several templates may be called up for calculations on commonly encountered processes (constant-volume, constant-entropy, irreversible adiabatic expansion, etc.). These templates are stored as files in the spreadsheet directory, and they provide a very clear display in which one can enter the input variables and generate quantities such as compression efficiency and steam quality. One template deals with the moisture content of air, enabling relative humidity to be calculated from dew point and vice versa.

The scientific basis of this product is the formulation adopted by the International Association for the Properties of Steam in 1984, as described in the *NBS/NRC Steam Tables*.[2] This formulation is based on a correlation of the very extensive data on water and steam carried out by the National Bureau of Standards and the National Research Council of Canada and is considered the definitive word on steam properties. Spot checks of the program calculations against the tables in the above book showed the level of agreement expected.

In summary, this package is well designed, easy to use, and scientifically sound. It has a clearly written manual with detailed instructions, examples, and reproductions of screen displays. For anyone who needs properties of water and steam, even on an occasional basis, it is well worth the 500 kbytes it occupies on the hard drive. For someone doing serious scientific or engineering calculations on steam, it will save an immense amount of time over programming the IAPS formulation one's self.

REFERENCES AND NOTES

(1) SteamTab is available from ChemicaLogic Corporation, 8 Cedar Street, Suite 56, Woburn, MA 01801-6362; Tel: 617-938-1151, Fax: 617-938-7722. The price is $119.00 plus $8.00 U.S. shipping ($15.00 international).

(2) Haar, L.; Gallagher, J. S.; Kell, G. S. *NBS/NRC Steam Tables*; Hemisphere Publishing Corp.: New York, 1984.

CI960123W