

PROBLEM SOLVER

Our spreadsheet series continues with a close look at TK!Solver, a modelling program from the creators of VisiCalc that takes the spreadsheet concept into a new direction: equation processing.

As we have seen in this series, microcomputer spreadsheet programs can be very useful for a variety of mathematical tasks. For the person accustomed to working on large row and column worksheets with a pencil and a calculator, the electronic spreadsheet is an invaluable time and energy saver. Nevertheless, spreadsheets do have significant limitations. The row and column format that is ideal for accounting or other financial models is often cumbersome, and at times useless, for higher level mathematical and scientific applications. And spreadsheets have a very rigid structure for handling equations.

Software Arts, the American company that created VisiCalc, has developed a program called TK!Solver that goes beyond spreadsheets in both form and function. 'TK!' stands for ToolKit, while 'Solver' is the section of code that actually processes equations. Besides differing from spreadsheets in screen format, TK! offers the

following unique features:

Backsolving — Spreadsheet formulae can solve for a single variable only. TK! can solve for any variable in an equation, if it is given enough data to do so;

Iteration — If a value required to solve an equation is missing or unknown, you can input a guess that TK! uses as a starting point. It then solves the equation through a series of successive approximations;

Unit conversion — TK! can convert values from feet to metres, dollars to pounds, etc., instantly from conversion tables;

Mathematical functions — TK! has a large number of these built in.

TK!SOLVER WORKSHEETS

The TK!Solver program operates through three linked worksheets, each with a specific function. The Variable sheet contains the names of all defined variables; columns for the user's input values and the program's output values; a place to indicate associated units, and space for the user to annotate each variable with a comment. The Variable sheet appears at the top of the program's initial display screen. Each variable is also described in detail on a separate variable subsheet. The Rule sheet is used to enter the equations TK! is expected to solve. An equation can be up to 200 characters long, and must conform to standard mathematical conventions of notation and operations. The Rule sheet fills the bottom portion of TK!'s opening screen. The Unit sheet stores the information needed to convert the units of measurement attached to the variables in a model.

TK!Solver uses these three sheets to perform most of its operations. Other sheets include a Global sheet, in which the user can customise some of TK!'s operating procedures; a List sheet that stores an array of values for variables; the User Function sheet, for user-defined functions; and sheets for plotting and printing points or tables of values.

CREATING A MODEL

We will begin by creating a very simple model adapted from the TK!Solver owner's manual that calculates mileage and average speed for an automobile journey, and converts the values from imperial to metric units. In TK!'s opening display, we find the cursor in the Rule sheet at the bottom of the screen. We begin by defining the variables in appropriate equations, so we type:

distance/time=speed

and press Return. Initially, TK! is set to read

