

zero, DYNAMO uses the first value in the PCRUM table; when IOPC.K is greater than 1600, it uses the last value.

Supplementary Equation

A supplementary equation defines an auxiliary variable that is used only to produce output such as indices of interest to the user. Crude birth rate CBR is a supplementary variable. Supplementary variables cannot be used to compute the values of other variables.

Special Functions: CLIP

$$A \quad NRUF.K = CLIP(NRUF2, NRUF1, TIME.K, PYEAR)$$

The CLIP function is one of several special functions available in DYNAMO. It is used to change the value of a variable, depending on the relative magnitude of two other variables. In the example given, NRUF has the value NRUF1 until TIME in the simulation run reaches PYEAR; then NRUF changes to NRUF2 and remains there for the duration of the run. Other special functions are described in Pugh (1970).

Specification Statement

The specification statement is identified by the letters SPEC. It contains information about the size of the time step DT, the time interval between plotted points PLTPER, and the time interval covered by a model run LENGTH.

$$SPEC \quad DT = 1/PLTPER = 5/LENGTH = 2100$$

In the example, DT was chosen to be 1 time unit. In this model, the time unit is one year. DT can be set to any fraction or multiple of a year; it is usually set small enough to avoid computational instabilities, yet large enough to keep the computing time reasonably short.

The quantities to be plotted are defined by a PLOT statement (described next). PLTPER was set to 5 time units in the preceding example, so that only the values at every fifth time unit are actually plotted. The LENGTH specification can take two forms. The internal variable, TIME, can be initialized by the programmer, for example:

$$N \quad TIME = 1900.$$

Here LENGTH = 2100 means that the run proceeds until TIME = 2100, that is, for 200 time units. If TIME is not explicitly initialized, the compiler supplies the initial value, TIME = 0, and the LENGTH specification then defines the number of time units for the run.

PLOT Statement

$$\begin{aligned} PLOT \quad & NRFR = N, FCAOR = F(0,1)/IC = C(0,4E13)/ \\ X \quad & IO = O(0,1E13)/POP = P(0,1.6E10) \end{aligned}$$

The variables whose values are to be plotted in graphical output are specified in a PLOT statement, which gives both the symbol used to plot the value of a variable

and the range of values to be plotted. For example, NRFR = N means that NRFR is plotted with the symbol N. The range of NRFR is determined implicitly by the compiler so that all values of NRFR that occur in a run are included in the graph. The specification POP = P (0,1.6E10) means that POP is plotted on a scale from 0 to 1.6×10^{10} . Values of POP outside this range do not appear on the graphical output. An X in the first column of a card indicates that the contents of the card are to be considered an extension of the expression on the preceding card.