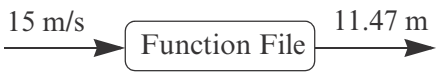
A very simple example of a user-defined function is a function that calculates the maximum height that a ball reaches when thrown upward with a certain velocity. For a velocity v_0, the maximum height h_{max} is given by $h_{\max} = \frac{v_0^2}{2g}$, where g is the gravitational acceleration. In function form this can be written as $h_{\max}(v_0) = \frac{v_0^2}{2g}$. In this case the input to the function is the velocity (a number), and the output is the maximum height (a number). For example, in SI units (g = 9.81 m/s^2) if the input is 15 m/s, the output is 11.47 m.



In addition to being used as math functions, user-defined functions can be used as subprograms in large programs. In this way large computer programs can be made up of smaller "building blocks" that can be tested independently. Function files are similar to subroutines in Basic and Fortran, procedures in Pascal, and functions in C.

The fundamentals of user-defined functions are explained in Sections 7.1 through 7.7. In addition to user-defined functions that are saved in separate function files and called for use in a computer program, MATLAB provides an option to define and use a user-defined math function within a computer program (not in a separate file). This can be done by using anonymous function, which is presented in Section 7.8. There are built-in and user-defined functions that have to be supplied with other functions when they are called. These functions, which in MATLAB are called function functions, are introduced in Section 7.9. The last two sections cover subfunctions and nested functions. Both are methods for incorporating two or more user-defined functions in a single function file.

7.1 Creating a Function File

Function files are created and edited, like script files, in the Editor/Debugger Window. This window is opened from the Command Window. In the Toolstrip select **New**, then select **Function**. Once the Editor/Debugger Window opens, it looks like that shown in Figure 7-1. The editor contains several pre-typed lines that outline the structure of a function file. The first line is the function definition line, which is followed by comments the describe the function. Next comes the program (the empty lines 4 and 5 in Figure 7-1), and the last line is an `end` statement, which is optional. The structure of a function file is described in detail in the next section.

Note: The Editor/Debugger Window can also be opened (as was described in Chapter 1) by clicking on the **New Script** icon in the Toolstrip, or by clicking **New** in the Toolstrip and then selecting **Script** from the menu that open. The