FEQinput: an editor for the Full Equations (FEQ) hydraulic modeling system

Background

The Full Equations Model (FEQ) is a computer program that solves the full, dynamic equations of motion for one-dimensional unsteady flow in open channels and through control structures. The open modular program code has led to the expansion of the applications of the program. FEQ has been used to design and operate flood control structures, delineate inundation maps and analyze peak flow impacts, and is currently being used to develop a system that uses floodplain models for real-time stream flow simulation that will aid in flood-fighting efforts.

Input files for the Full Equations Model are composed of text files that contain large amounts of parameters, data, and instructions written in a format exclusive to FEQ. Although documentation exists that can aid in the creation and editing of these input files, there is a steep learning curve for understanding the specific format and language of the files. FEQinput is a line editing tool that enables users to understand, modify, search, test, and save results from input files.

Introduction

FEQinput provides a set of tools to help a new user create and modify input files for the FEQ hydraulic model and for the related utility tool, Full Equations Utilities (FEQUTL). The current capabilities of the program include displaying descriptions of lines in FEQ and FEQUTL input files, searching for a given string of text within an opened file, navigating large files with "block buttons" that allow users to jump to a specific section of the file, single-line and multi-line editing for the text files that updates the display descriptions, ability to save new input files or modify existing ones, and "run" capability that automatically runs the respective program with the input file and displays the output of the program. These functionalities will be discussed in the following sections.

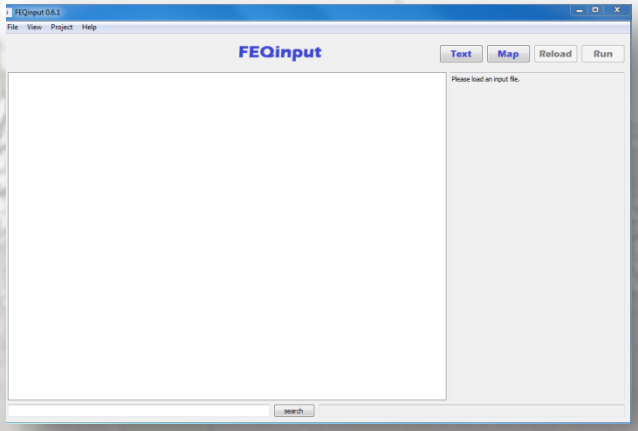

Figure 1: FEQinput interface

Loading Files

Opening FEQinput

The main window of FEQinput (Figure 1) contains an input space (left), and a text display space (right). Text files will be displayed on the left, and description of the selected line on the right side. To open an input file, click "File" on the menu and then click on "Open .FEQ file" or "Open .FTL file" for FEQ and FEQUTL files, respectively. Not all input files will have the same extensions (.feq or .ftl), so in the case of a different extension, select to show "All Files" by using the dropdown menu on the file selection dialog (Figure 2). Once a file is opened, its path and filename will be displayed in the bottom-right corner of the program.

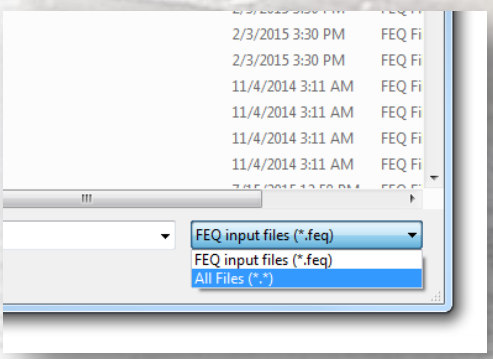

Figure 2: Opening a file

Reading Input Lines

After opening a file, its contents will display on the left-side table in the program. The table contains three columns: the number of the line, a code for each line, and the contents of each line. The code is a small combination of alphanumeric characters that FEQinput uses to identify and interpret the contents of a line. The code column can help the user find lines that the program cannot read (code: "NOREAD") and fix any mistakes within those lines.

The contents of the input file are displayed in the third column. Each line of the input file is placed on a table row. To interpret the contents of a line, the user can click on the desired line. A description of the contents of the line, along with definitions and parameters, will be displayed on the right side of the main FEQinput window. When reopening or reloading files, the table columns may shrink in size to match the size of the visible rows. The table columns can be resized by dragging the column headers.

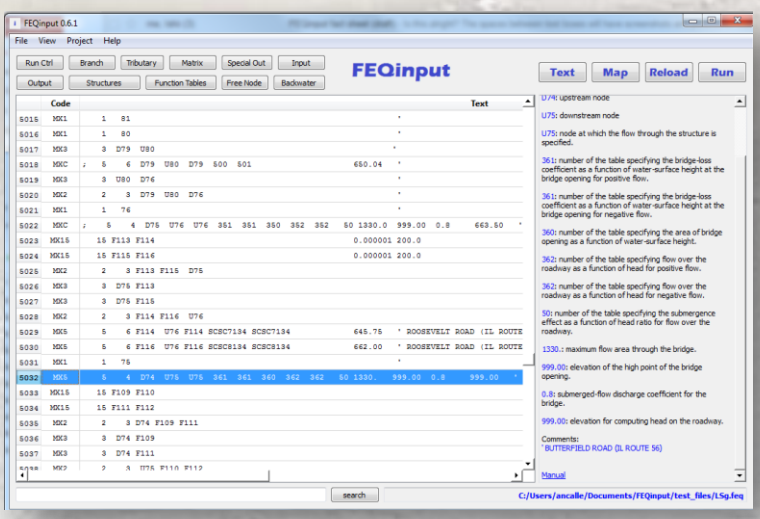

Figure 3: FEQinput interface with opened file. The left side displays the input file while the right panel displays definitions and parameters of the selected (blue) line.

Navigation and Searching in Files

While some input files can be as short as a few hundred lines, other files can range between thousands and tens of thousands of lines. To expedite navigation through these files, FEQinput includes options (in addition to using the scrollbar or arrow keys) to navigate within input files. For FEQ files only, the program provides navigation buttons on the top left corner of the window. When clicked, these buttons navigate to a specific section of the input file. If the input file does not contain a section, the button for that section will be disabled to avoid confusion.

Another way to navigate within the input files is to do a search. The search bar (located at the bottom left corner) provides an easy way to find a desired line of input, such as section headers, parameters, or comments. To use the search feature, type the desired phrase to find and click on "search". A dialog with extra options will open with the option to "search within a block" (for FEQ files only). This option limits the search to only a specific section of the file. The search is not case-sensitive.

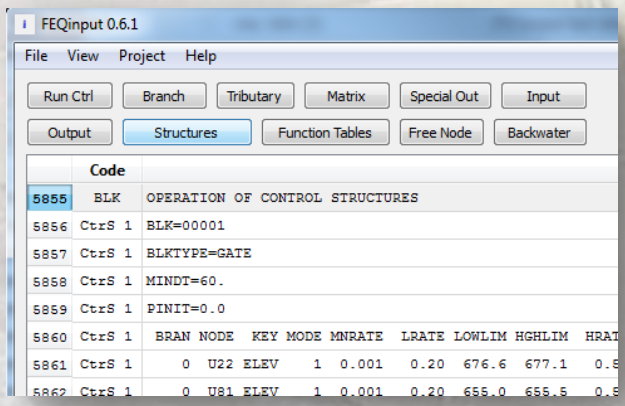

Figure 4: Navigation buttons (this feature is only available for FEQ files)

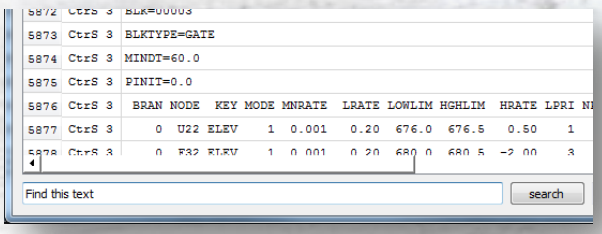

Figure 5: The search bar is located at the bottom left corner of the program window

Editing and Saving Files

Single-Line Editor

In addition to helping the user understand the contents of an input file, FEQinput also allows the user to modify the file and see how the modifications will be interpreted by FEQ or FEQUTL. This can be done in two ways. The first is to edit a line directly in the display table. To edit a single line, the user can double-click on it. After modifying the contents of the line, the changes will be interpreted by FEQinput after pressing the enter key and selecting the line again. If the line does not provide the required or expected results (for example, when inserting or removing comments), the user can click on the Reload button (located at the top right corner, or by selecting from the menu Project >> Reload, or by pressing CTRL+SHIFT+R), which loads the edited input file again, to display the correct information on the display box. This single-line edit functionality is good for first-time users, or to modify simple parameters. It is important to note that because the FEQ format alternates between using spaces, variable types, headers, and code words as part of the formatting parameters, the user must keep in mind the position, number of characters, and variable-type of the object when editing a line.

Multi-Line Editor

The second form of editing input files is by using a provided multi-line editor. This tool allows users to edit the input text file in its raw format through a simple text editing interface. This is similar to editing a file in Windows Notepad. To load the multi-line editor, the user must click on the Text button in the top right corner, or select from the menu View >> Text Mode. After editing the text file using the multi-line editor, clicking on the Apply Edits button at the bottom right corner of the editor will load the changes into the main table to display and interpret the modified text. This function is useful to copy and paste large lines of text and to add or remove lines from the input file.

Saving Files

If the user is satisfied with the changes made to the input file, FEQinput can save the changes into the original file by selecting from the menu File >> Save, or by pressing CTRL+S. If the user prefers to have different files of the different versions, the program can save the changes into a new file by selecting from the menu File >> Save As, or by pressing CTRL+SHIFT+S. It should be noted that even though changes are made to an input file and the model is run or reloaded through FEQ or FEQUTL, these changes will not be written into the file until the user chooses to save the file. This enables testing of the changes prior to committing them as a user option.

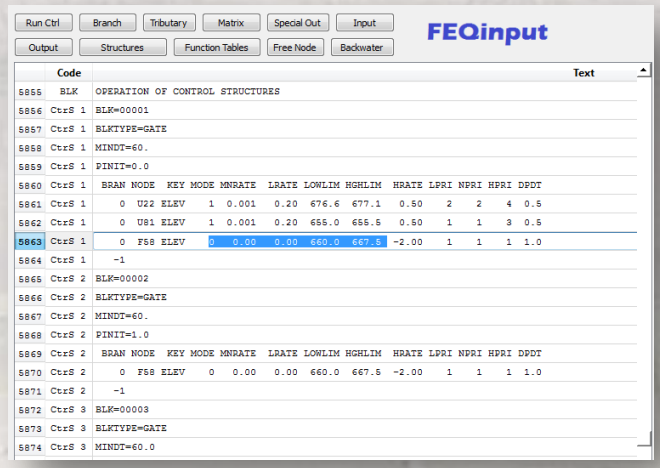

Figure 6: Single-line editor

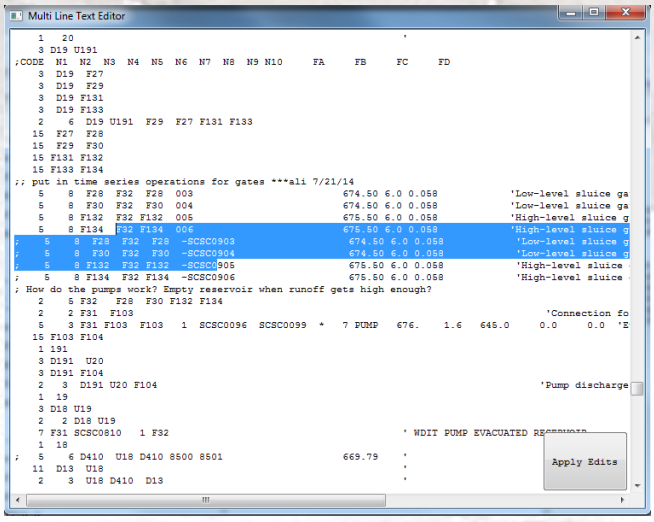

Figure 7: Multi-line editor

Running models

Once an input file is properly modified or inspected, the user can run this file with FEQ or FEQUTL by clicking the Run button at the top right corner, or by selecting from the menu Project >> Run, or by pressing CTRL+R. If the program runs correctly, the output of the model will open in a new window. This output is saved in the same folder as the FEQinput executable with the name "output". In order for a model to run correctly, the FEQinput executable file should be in the same directory as the FEQ or FEQUTL executable files. For FEQUTL, the executable files also must be located in the same directory as the input file.

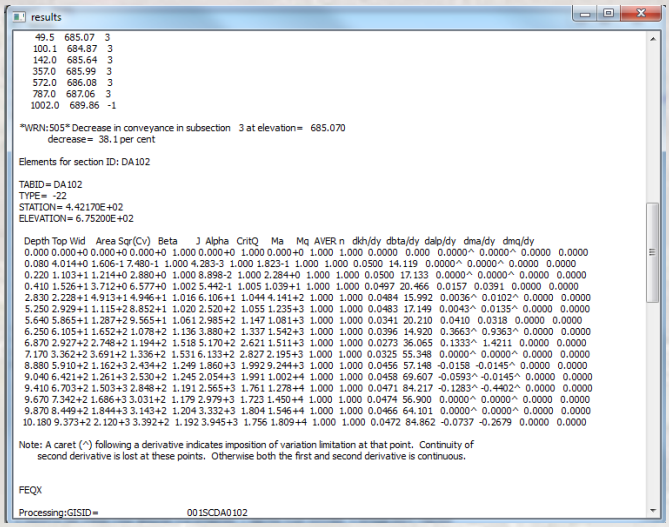

Figure 8: Sample FEQUTL output file

Conclusion

Both new and experienced users can benefit from the capabilities of FEQinput. Different ways to edit input files give the user enough flexibility to work at any desired pace. FEQinput provides a simple and quick solution for users to work with in order to get familiarized and experienced with FEQ models.

Additional Information

FEQinput does not require installation in order to run. To open the program, the user can download and unzip the distributed package and double-click on the file named *FEQinput.exe*. FEQinput supports FEQ and FEQUTL files of any format, but works best on files made for FEQ version 10.61 or higher. Formatting inconsistencies and errors in files may prevent FEQinput from functioning as intended.

FEQinput was developed in Python, using Qt libraries. Text formatting was written in HTML and CSS. Most of the graphical components were designed using Qt Designer, and the code was written in Python's standard interface IDLE. External modules for Python include: PyQt4 and PyInstaller.

Questions and Feedback

Questions and comments relating to technical aspects of the program, as well as requests for support and additional development, can be directed to the developers:

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