

## Instructions for Applying a Butterworth Filter Using Matlab

In this document, the steps necessary for applying a Butterworth filter to M-stationary data are given.

Obtaining the dual in S-Plus:

1. Run the data through the M-stationary program on S-Plus.

This program is available through the Department of Statistics at SMU.

It is located at the following website. <http://faculty.smu.edu/hgray>,

and instructions on using the M-stationary library are included.

2. Be sure to export the dual by clicking on the “Results” tab and then on the “Export Dual” button. This will allow the user to save the data in the appropriate location.

Using Matlab to Butterworth lowpass filter the data:

3. Import the data into Matlab by following the instructions on Matlab’s “Import Wizard”.

For the purposes here, suppose the dual dataset is called `series1` in Matlab.

4. The following command will create a second order lowpass Butterworth filter.

```
[b,a]=butter(2,.1);
```

For other orders, import the order number in place of the 2.

5. To apply the filter to `series1`, use

```
filt=filter(b,a,series1);
```

6. To save the filtered data in ASCII format, the command is

```
save series1f2.out filt -ASCII;
```

The file will be saved as `series1f2.out` in ASCII format.

For a quick reference for the command in step 4 pertaining to each filter type, see Table 1.

Table 1: Quick Reference for Matlab Butterworth Filters

Filter Type	Command	Comments
Lowpass	<code>[b,a]=butter(2,.1);</code>	Applies a second order filter that passes all frequencies below 0.10
Highpass	<code>[b,a]=butter(2,.1,'high');</code>	Applies a second order filter that passes all frequencies above 0.10
Bandpass	<code>[b,a]=butter(2,[.1,.2]);</code>	Applies a second order filter that passes all frequencies between 0.10 and 0.20
Bandstop	<code>[b,a]=butter(2,[.1,.2],'stop');</code>	Applies a second order filter that stops all frequencies between 0.10 and 0.20