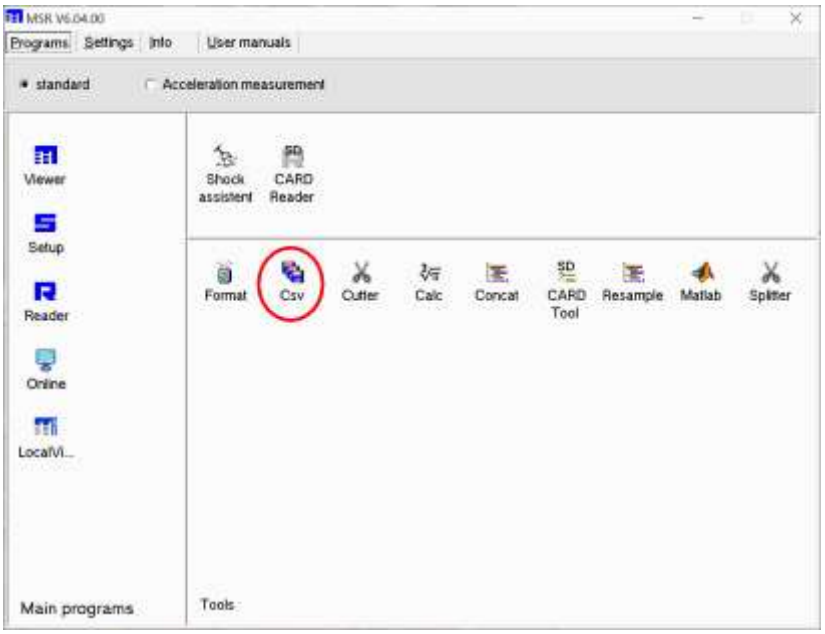
Shock data processing

The conventions used below are as follows:

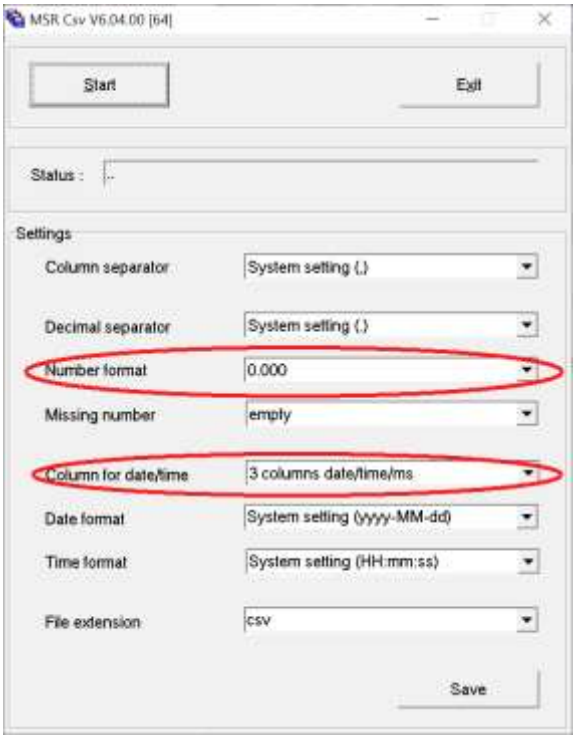
- The `Courier font` indicates things you see in the terminal window or must type into the terminal window.
- Items between angle brackets <> indicate a key to be pressed, e.g. `<Entre>` means press the Enter key.
- *Italics* indicate where you have to supply information, e.g. *`filename`* means you must enter the name of the file to be used.

1. Export msr data to csv

a) Using the MSR V6.04.00 software, open the `msr2csv` program.



b) Select **`Number format`** `0.000` and **`Column for date/time`** `3 columns date/time/ms`



c) Click Start and select the first MSR file to export. Repeat for each MSR file
d) Save the resultant .csv files in a convenient folder in the root of the C:\ drive (e.g. C:\temp, or if this already exists C:\temp\MSR).

2. Separate the data in acceleration and temperature/humidity

[A copy of the terminal window appears below.]

a) Copy the files `separate.bat`, `filter.bat`, `filter2.exe`, `wc.exe` and `sed.exe` to this new folder.
b) Open a terminal window by pressing the Windows key followed by `cmd` and `<Enter>`.
c) Change to the folder in which the files are stored by typing `cd C:\temp\MSR` (or `cd C:\temp`) and press `<Enter>`. The command line prompt changes to `C:\temp\MSR` to show in which folder you are located.
d) You can check the files in the folder by typing `dir` then `<Enter>`. You can add wild cards to the `dir` command to see only certain files, e.g. `dir MSR*` will show only files starting MSR.
e) Type `separate` *`filename`* `<Enter>`. The *`filename`* is **WITHOUT** the `.csv` at the end.
f) This routine produces two files, one of the temperature data ending `_temp.csv` and one of the acceleration data ending `_acc.csv`.

3. Filter the data

a) Type `filter` *`acceleration_filename threshold before after`* `<Entre>`. Again, this *`filename`* is WITHOUT the `.csv` at the end. `Threshold` is the value to be exceeded for the record to be included in the output file; `before` is the number of records before the threshold is exceeded that are also output to the file; `after` is the number of lines after the value falls back below threshold output to the file. Together this constitutes an event.
b) This produces two files. The first file will be produced with the ending `_threshold_before_after.csv`.
c) One blank line is placed after each event.
d) This output file has the fields Date, Time, ms, X, Y, Z, scalar. There are no header labels, these need to be added in Excel. Scalar is the magnitude of the vector, calculated as sqrt(x^2+y^2+z^2).
e) A second file with the ending `_threshold_before_after_count.txt` is a simple text file with three lines, the file name, the total number of lines in the csv file and the number of events.
Note that I have corrected the script to show the number of lines correctly.

4. Post processing

a) Open the final csv file in Excel.
b) Save the file in xlsx format.
c) Add a blank row at the top and enter the headings:

Date	Time	ms	X	Y	Z	Scalar	-	Change scalar	Change vector	Angle	Hz

d) Note that there is one blank column between `Scalar` and `Change scalar`

e) In the column with the blank heading, starting in row 2 insert 1, 2, etc. down the column to the last entry in the file. This is only used to help copy formulae in the sheet.

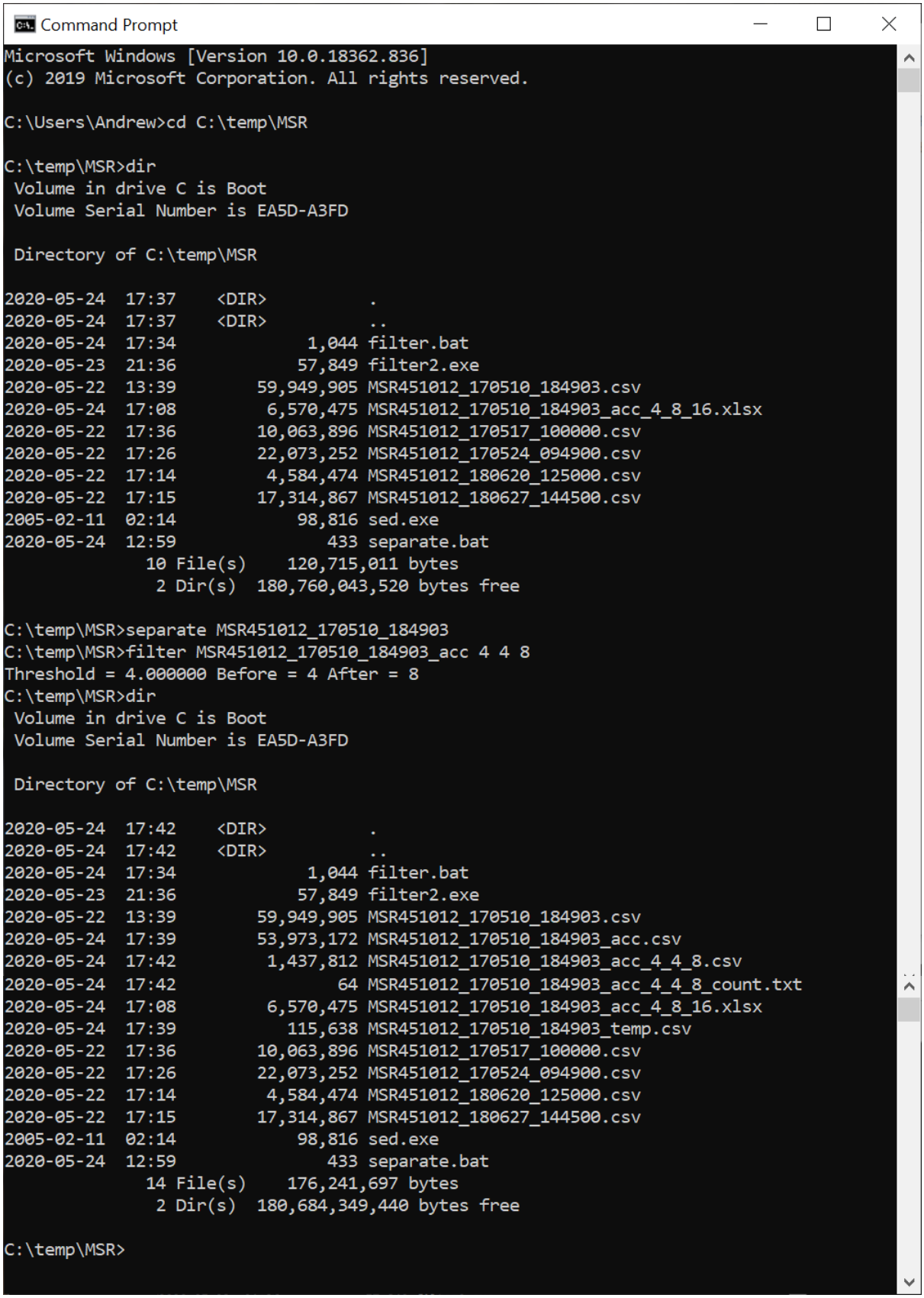
f) In the column `Change scalar`, in row 3, enter the formula
=IF(OR(G2=0,G3=0),"",G3-G2)
This is the simple change in the magnitude of the two successive scalars without taking account of the change in angle.

g) In the column `Change vector` in row 3 enter the formula
=IF(OR(G2=0,G3=0),"",SQRT((D2-D3)^2+(E2-E3)^2+(F2-F3)^2))
This is the magnitude of the resultant vector between the two vectors taking into account the angle change.

h) In the column `Angle` enter the formula:
=IF(J3="","",ACOS((D2*D3+E2*E3+F2*F3)/(G2*G3)))
This is the angle between the two successive vectors. This allows us to calculate the frequency of the vibration.

i) In the column `Hz` enter the formula:
=IF(K3="","",K3/(2*PI())*1600)
This is an approximation to the vibration frequency in Hz. As the recorder takes 1600 measurements per second it cannot measure frequencies above 800 Hz.

j) Select the range I3:L3 and copy down the complete sheet by placing the mouse on the small black block at the bottom right corner and double clicking.


Command Prompt
Microsoft Windows [Version 10.0.18362.836]
(c) 2019 Microsoft Corporation. All rights reserved.
C:\Users\Andrew>cd C:\temp\MSR
C:\temp\MSR>dir
Volume in drive C is Boot
Volume Serial Number is EA5D-A3FD
Directory of C:\temp\MSR
2020-05-24 17:37 <DIR> .
2020-05-24 17:37 <DIR> ..
2020-05-24 17:34 1,044 filter.bat
2020-05-23 21:36 57,849 filter2.exe
2020-05-22 13:39 59,949,905 MSR451012_170510_184903.csv
2020-05-24 17:08 6,570,475 MSR451012_170510_184903_acc_4_8_16.xlsx
2020-05-22 17:36 10,063,896 MSR451012_170517_100000.csv
2020-05-22 17:26 22,073,252 MSR451012_170524_094900.csv
2020-05-22 17:14 4,584,474 MSR451012_180620_125000.csv
2020-05-22 17:15 17,314,867 MSR451012_180627_144500.csv
2005-02-11 02:14 98,816 sed.exe
2020-05-24 12:59 433 separate.bat
10 File(s) 120,715,011 bytes
2 Dir(s) 180,760,043,520 bytes free
C:\temp\MSR>separate MSR451012_170510_184903
C:\temp\MSR>filter MSR451012_170510_184903_acc 4 4 8
Threshold = 4.000000 Before = 4 After = 8
C:\temp\MSR>dir
Volume in drive C is Boot
Volume Serial Number is EA5D-A3FD
Directory of C:\temp\MSR
2020-05-24 17:42 <DIR> .
2020-05-24 17:42 <DIR> ..
2020-05-24 17:34 1,044 filter.bat
2020-05-23 21:36 57,849 filter2.exe
2020-05-22 13:39 59,949,905 MSR451012_170510_184903.csv
2020-05-24 17:39 53,973,172 MSR451012_170510_184903_acc.csv
2020-05-24 17:42 1,437,812 MSR451012_170510_184903_acc_4_4_8.csv
2020-05-24 17:42 64 MSR451012_170510_184903_acc_4_4_8_count.txt
2020-05-24 17:08 6,570,475 MSR451012_170510_184903_acc_4_8_16.xlsx
2020-05-24 17:39 115,638 MSR451012_170510_184903_temp.csv
2020-05-22 17:36 10,063,896 MSR451012_170517_100000.csv
2020-05-22 17:26 22,073,252 MSR451012_170524_094900.csv
2020-05-22 17:14 4,584,474 MSR451012_180620_125000.csv
2020-05-22 17:15 17,314,867 MSR451012_180627_144500.csv
2005-02-11 02:14 98,816 sed.exe
2020-05-24 12:59 433 separate.bat
14 File(s) 176,241,697 bytes
2 Dir(s) 180,684,349,440 bytes free
C:\temp\MSR>