Note: This is an unofficial version of the file smcfmt.txt available from http://escweb.wr.usgs.gov/nsmp-data/smcfmt.html. It has been modified slightly by me (D. M. Boore) by allowing a higher precision format for the data. This is indicated by the value for using int_head(47), as indicated below. I have deleted all discussion of the bbf binary file format, which is not used in my programs; see the original version of this file for that material.

SMC-format Data Files

Table of Contents

1.0 Introduction

The strong-motion time series data served out by the U.S. Geological Survey National Strong-Motion Program are in SMC format. This documentaton describes the SMC-format.

The SMC format uses ASCII character codes and provides text headers, integer headers, real headers, and comments followed by either digitized time-series coordinates or, in version 2 of the SMC format only, sets of response spectra values. The header information is designed to provide the user with information about the earthquake and the recording instrument. Each SMC-format file contains either a single time series or a set of response spectra calculated or Fourier amplitude spectra of corrected acceleration from a single time series. Typical analog strong-motion records contain traces corresponding to three orthogonal components of motion and consequently require three separate SMC-format files to represent the record.

2.0 Sample File

Here follows a sample unevenly-sampled, uncorrected SMC-format time-series file from which most of the time series values have been removed:

```
1 UNCORRECTED ACCELEROGRAM

*

DVD0D
     1989  10  18    0004 Loma Prieta, CA
Moment Mag=      6.9 Ms=      7.1 Ml=      7.0
station = Del Valle Dam, toe             component=     65
epicentral dist =     66.0       pk acc =     54.8
inst type=SMA-1      data source = CDWR/USGS
*
*
*
    -32768      1989       291         0         4         0    -32768       451
         1         3         6    -32768        90        65       101         8
     41320    -32768         3    -32768    -32768    -32768    -32768    -32768
    -32768    -32768    -32768         1    -32768      1265    -32768    -32768
    -32768    -32768    -32768    -32768    -32768    -32768    -32768    -32768
    -32768    -32768    -32768    -32768    -32768    -32768    -32768    -32768
  0.1700000E+39  0.1700000E+39  0.3703700E+02 -0.1218830E+03  0.1800000E+02
  0.7100000E+01  0.7100000E+01  0.7000000E+01  0.1700000E+39  0.1700000E+39
  0.3761500E+02 -0.1217450E+03  0.1700000E+39  0.1700000E+39  0.1700000E+39
  0.1700000E+39  0.6600000E+02  0.1700000E+39  0.1000000E+05  0.1700000E+39
  0.1700000E+39  0.2540000E+02  0.6000000E+00  0.2000000E+01  0.1700000E+39
  0.1700000E+39  0.1700000E+39  0.1700000E+39  0.9798830E+01  0.5482899E+02
  0.9609058E+01 -0.4761129E+02  0.1700000E+39  0.1700000E+39  0.1700000E+39
```

```
  0.1700000E+39  0.1700000E+39  0.1700000E+39  0.1700000E+39  0.1700000E+39
  0.1700000E+39  0.1700000E+39  0.1700000E+39  0.1700000E+39  0.1700000E+39
  0.1700000E+39  0.1700000E+39  0.1700000E+39  0.1700000E+39  0.1700000E+39
|
|  Put comments here.
|  Explain about any peculiarities in the record, any difficulties in
|    digitizing, etc.
|  If no comments are necessary, place a single line with "|" in the
|    first column this section.
|  Set integer header cell # 16 = number of comment lines = 9 here.
|  <pltlbl=> Sample plot label here <end>
|
 0.0000E+0 7.3789E-2 2.4847E-3 9.0424E-1 5.9633E-3 1.3411E+0 7.3548E-3 1.4865E+0
 8.8456E-3 1.6317E+0 1.0336E-2 1.8260E+0 1.1728E-2 2.1184E+0 1.3219E-2 2.5088E+0
 1.4610E-2 2.5071E+0 1.6101E-2 2.8484E+0 1.7492E-2 2.6996E+0 1.8983E-2 3.0409E+0
 2.0375E-2 3.2843E+0 2.1866E-2 3.2334E+0 2.3257E-2 3.3788E+0 2.4748E-2 3.2298E+0
 2.6139E-2 3.5223E+0 2.7630E-2 3.4714E+0 2.9121E-2 3.8127E+0 3.0512E-2 3.6148E+0
 3.2003E-2 3.7110E+0 3.3395E-2 3.6112E+0 3.4885E-2 3.6093E+0 3.6277E-2 3.3399E+0

    ... most of the time-series lines were removed here ...

 2.9598E+1 1.9508E+0 2.9599E+1 1.6998E+0 2.9600E+1 2.1248E+0 2.9602E+1 1.9473E+0
 2.9603E+1 2.1673E+0 2.9605E+1 2.2120E+0 2.9606E+1 2.3576E+0 2.9608E+1 2.5521E+0
 2.9609E+1 2.5016E+0 2.9610E+1 2.4020E+0 2.9612E+1 2.3024E+0 2.9613E+1 2.5459E+0
 2.9615E+1 2.4463E+0 2.9616E+1 2.4938E+0 2.9618E+1 2.3452E+0 2.9619E+1 2.6869E+0
```

3.0 Headers

There are four types of headers in SMC format files: text headers, integer headers, real headers, and comments. The 11 text header lines provide a little prose designed to allow a user to identify quickly the earthquake and recording station. Then follow 6 lines of integer header values and 10 lines of real header values. Following the text, integer, and real headers are a variable number of comment lines that can contain additional information about the earthquake or the record. Then follow either digitized time-series values or several sets of response spectra values. The number of comment lines included in the file is indicated in the 16th integer header value and the number of time-series values is indicated in the 17th integer header value.

Both the integer and real headers have many cells that contain a value that indicates "undefined"; these cells are either filled in subsequent stages of data processing or are merely included in the file format so that more information can be added to future files without changing the format. The value used to indicate "undefined" in integer header cells is usually "-32768"; the value used in real header cells is usually "+1.7e+38".

The Fortran format for each integer header line is "(8I10)", for each real header line is "(5E15.7)", and for each time-series line is "(8(es10.4e1))" (unless int_head(47) = 8, in which case the format is "(5(es14.7e1))". In my

TSPP programs, the subroutine *smcwrite* replaces the time series value y with 0.0 if abs(y) < 1.0e-09 (otherwise, the value is stored as ********, because an exponent of -10 is larger than allowed by the format statement).

There are 6 integer header lines with 8 values per line, for a total of 48 integer values. There are 10 real header lines with 5 values per line for a total of 50 real header values. There are 11 text header lines and there are as many comment lines as are indicated in integer header cell #16.

3.1 Text Headers (fixed format)

There are 11 text-header lines in a SMC-format time-series data file. They have the following format:

```
0        1         2         3         4         5  (columns for reference)
12345678901234567890123456789012345678901234567890  (columns for reference)

# <--- text ------------->
*
SSSSA
     YYYY  MM  DD    TIME <-- earthquake name here ---------------------->
Moment Mag=      #.# Ms=      #.# Ml=      #.#
station = <--- station name here ------> component= ###
epicentral dist =     ##.#       pk acc =    ###.#
inst type=SMA-1      data source = USGS/VVVV
*
*
*

12345678901234567890123456789012345678901234567890  ( <= columns)
0        1         2         3         4         5  (      "    )


line 1:  Contains a number in column 1 followed by text in columns 3-26, both
             of which indicate which type of data is contained in the file. The
             contents of the first line can be one of the following:
             "0 UNKNOWN"    (BAP will treat this like UNCORRECTED ACC)
             "1 UNCORRECTED ACCELEROGRAM" (Also referred to as Volume 1 data)
             "2 CORRECTED ACCELEROGRAM" (Volume 2)
             "3 VELOCITY" (Volume 3)
             "4 DISPLACEMENT" (Volume 4)
             "5 RESPONSE SPECTRA" (Volume 5)
             "6 FOURIER AMPLITUDE SPECTRA OF CORRECTED ACCELERATION" (Volume 6)
line 2:  "*" in column one
line 3:  Either a "*" in column one, or columns   1-4 = Station code
         column      5 = "A", "B", "C", ... to indicate which of the several
                         accelerometer traces on the record is digitized
                         in this file.  "A" is the topmost accelerometer trace,
                         "B" is the second from the top, etc.
    Note: in files that come from the DDS#7 CD-ROM, columns 1-5 of line 3 should
                         correspond with the 5-character station-component code
```

```
                          used in the file name.  See Section 7.2
line 4:  columns  1-3   = time zone if the time zone is other than GMT. This
                          field will be blank in all the files on the CDROM(s).
                          But it may indicate a time zone other than GMT in some
                          files created by the V2S reformatting program (which
                          doesn't know how to convert from all the various time
                          zones to GMT).
         columns  6-9   = earthquake year (four digits)
         columns 12-13 =      "     month
         columns 16-17 =      "     day
         columns 22-25 =      "     hour, minute in GMT
         columns 27-80 = earthquake name (left justified)
line 5:  columns  1-11 = "Moment Mag="
         columns 12-20 = moment-magnitude value
         columns 22-24 = "Ms="
         columns 25-33 = Surface-wave magnitude value
         columns 35-37 = "Ml="
         columns 38-46 = Local magnitude value
line 6:  columns  1-10 = "station = "
         columns 11-40 = station name, left justified
                          (Note:  Some files incorrectly have the station
                                  number instead of name in this field).
         columns 42-51 = "component= "
                          (Note:  Some files have the "c" was in column 41
                                  instead of column 42!
         columns 53-57 = orientation of the recording transducer
                          (Note:  There seems to be no convention for where
                                  the value is placed in these columns.)
line 7:  columns  1-17 = "epicentral dist ="
         columns 18-26 = epicentral distance in kilometers
         columns 34-41 = "pk acc ="
         columns 42-50 = peak value of the time series given in this file
line 8:  columns  1-10 = "inst type="
         columns 11-15 = "SMA-1" or "CRA-1" or whatever to indicate the type
                          of recording instrument.
         columns 22-34 = "data source ="
         columns 36-80 = an abbreviation indicating the agency that provided
                          the data.  "USGS", "CSMIP", etc.
lines 9, 10, and 11:  a "*" in column one.
```

3.2 Integer Headers (48 values, 6 lines in "(8I10)" format)

The values given in integer header cells have the following meanings:

```
  cell
number   description
------   -----------
     1   Value representing "undefined" or "null" in the integer header.
              This is usually (always?) set to  "-32768".
     2   Time of first recorded sample, year (4 digits),  GMT
     3                    "              day of year  (julian day)
     4                    "              hour
     5                    "              minute
     6                    "              second
```

```
 7                "              millisecond
 8   Recorder serial number
 9   Channel number of the digitized trace given in this file.
          Channel numbers are counted sequentially, top-to-bottom,
          with the top-most accelerometer trace counted as #1.
10   Total number of channels (=accelerometer traces) on this record.
11   Total number of channels recorded at this station
12   Sensor serial number
13   Vertical orientation (degrees from up)
          0 < integer cell #13 < 180, usually 0 (UP = 0, DOWN = 180).
          Null value should be used when sensor is a horizontal component.
14   Horizontal orientation (degrees east of north)
          0 < integer cell #14  < 360. Null value should be used
          when sensor is a vertical component.
15   Sensor type code:
            2  Sprengnether SA-3000 3-component fba
           30  Kinemetrics FBA-13   3-component fba
           31  Kinemetrics FBA-11   1-component fba
          101  SMA-1                    125  Kinemetrics FBA-23
          102  C&GS Standard            126  Kinemetrics Episensor
          103  AR-240                   127  Kinemetrics FBA-4g
          104  RFT-250                  128  Kinemetrics FBA-2g
          105  RFT-350                  129  Kinemetrics FBA-1g
          106  MO-2                     130  Kinemetrics FBA-0.5g
          107  RMT-280                  131  Kinemetrics FBA-0.25g
          108  SMA-2/3                  132  Kinemetrics FBA-0.1g
          109  DSA-1/DSA-3              133  WR1
          110  DCA-300                  134  S6000
          111  DCA-333                  135  Mark Products L22
          112  A-700                    136  Products L4C
          113  SSA-1                    137  CMG3
          114  CRA-1                    138  CMG3T
          115  MO-2                     139  CMG40T
          116  FBA-3                    140  CMG5
          117  SMA-2                    141  KS-2000
          118  DCA-310
          119  FBA-13
          120  SSA-2
          121  SSR-1
          122  BIDRA
          123  CR-1
          124  PDR-1                    900  custom instrument
16   Number of comment lines following the header information.
17   Number of time-series values.  Note that the number of "values"
          specified here should be the number of time-series samples if the
          time series is evenly sampled, twice the number of samples if the
          time series is unevenly sampled (because two values, abscissa and
          ordinate, are given for each sample when the time series is
          unevenly sampled).
18   Problem flag -  This is usually set to "undefined", but if there is a
          problem with the record, such as spikes or unusual noise, or
          unusual noise, it should be set to 1, in which case additional
          information should be available in the comments section.
19   Type of structure:  1 = building,  2 = bridge,
                         3 = dam,       4 = other,
                       null = not a structure.
20   Structure number corresponding to printed information.
```

```
21   Transducer number of the recording system as shown on the drawing.
22   Total number of transducer channels for this structure.

The following integer parameters are for buildings (when
       Integer cell #19 = 1):
23   Number of floors above grade, including the roof.
24   Number of stories below grade.
25   Floor on which this sensor is located
          -1  1st subbasement, etc
           0  basement
           1  grade level
           2+ floor levels above grade

The following are for bridges (when Integer cell #19 = 2):
26   Number of spans
27   Location of transducer
           0  free field
           1  at the base of a pier or abutment
           2  on an abutment
           3  on the deck at the top of a pier
           4  on the deck between piers or between an abutment and a pier

The following are for dams (when Integer cell #19 = 3):
28   Location of this transducer
           0  upstream or downstream free
              field
           1  at the base of the dam
           2  on the crest of the dam
           3  on the abutment of the dam
29   Type of construction
           1  Reinforced concrete gravity
           2  Reinforced concrete arch
           3  earth fill
           4  other
30   Station number (This will be "undefined" if the station "number"
                    includes alphabetic characters, in which case it will be
                    indicated in the station name field in text header line
                    6.)
31   First recorded sample.  This will be "undefined" or 1 if the first
          recorded sample is the first sample given in the time series.
          (This info is required because the BAP software adds leading and
          trailing zero pads to the time series before filtering.  BAP
          output files may include these leading and trailing pad areas,
          which after filtering will contain small filter transients.
          Integer header cells #31 and 32 indicate where the actual
          recorded time series begins and ends.)
32   Last recorded sample.
33   Refer to another file flag.  If this not "undefined" it indicates that
          users should refer to the file indicated in the second line of
          the comments for more information about the data in the current
          file.  Plotting programs like BAP and TSPLOT should display that
          second comment line along with plots of this data.
34-39   Undefined
40-41   Reserved for user
42-46   Undefined
47   =undefined for data in standard format, =8 for data in higher
     precision format (see below for data formats)
```

```
    48   Clock source (Kinemetrics Altus)
              0  RTC (internal clock)
              1  Keyboard
              2  Sync with external reference pulse
              3  GPS (= -1 if a correction for GPS rollover beginning Aug. 23,
                 1999, was made to original file time
```

3.3 Real Headers (50 values, 10 lines in "(5E15.7)" format)

The values given in real header cells have the following meanings:

```
  cell
number   description
------   -----------

     1   Value representing "undefined" or "null" in the real header. This is
              usually set to "+1.7e+38".  The use of the "-0.3e-38" value found
              in some older files on the USGS VAXes is not recommended because
              that number is out of range and not acceptable to the floating-
              point representation used on PCs and most UNIX computers.
     2   Sampling rate (samples per second) for evenly-sampled time series;
              "undefined" for unevenly-sampled time series.
     3   Earthquake latitude (decimal degrees; "+" for Northern Hemisphere)
     4   Earthquake longitude (decimal degrees; "-" for Western Hemisphere)
     5   Earthquake depth (km relative to sea level)
     6   Source magnitude M   (moment magnitude)
     7     "        "     MS  (surface-wave magnitude)
     8     "        "     ML  (local magnitude)
     9     "        "     M   (other)
    10   Seismic moment (dyne-cm; 1 newton-meter = 10**7 dyne-cm)
    11   Station latitude (decimal degrees; "+" for Northern Hemisphere)
    12   Station longitude (decimal degrees; "-" for Western Hemisphere); some
         files incorrectly have positive value here
    13   Station elevation (m relative to sea level)
    14   Station offset N (m)
    15   Station offset E (m)
    16   Station offset up (m)
    17   Epicentral distance (km)
    18   Epicenter to station azimuth (degrees east of north)
              0.0 < real header cell #18 < 360.0
    19   Digitization units (units/cm) for analog-recorded data;
              Digitizing constant (counts/volt) for digitally-recorded data.
    20   Undefined for analog-recorded data; anti-alias filter corner
              frequency (Hz) for digitally-recorded data.
    21   Undefined for analog-recorded data; anti-alias filter poles
              (6dB/octave per pole) for digitally-recorded data.
    22   Natural frequency of the sensor (Hz)
    23   Sensor damping coefficient (fraction of critical)
    24   Recorder sensitivity (cm/g) for analog-recorded data;
              Coil constant (volts/cm/sec/sec) for digitally-recorded data.
    25   Undefined for analog-recorded data;  amplifier gain (dB) for
              digitally-recorded data.
    26   Undefined for analog-recorded data;  pre-amp gain (dB) for
              digitally-recorded data.
    27   Undefined in version 2.  (Had been a suggested corner frequency
```

```
            for high-pass filter in version 1 SMC files.)
    28   Undefined in version 2.  (Had been a suggested corner frequency
            for low-pass filter in version 1 SMC files.)
    29   Time of the time-series maximum (largest positive) value (seconds)
    30   Value of the maximum value (cm/sec/sec, cm/sec, or cm)
    31   Time of the time-series minimum (largest negative) value (seconds)
    32   Value of the minimum value (cm/sec/sec, cm/sec, or cm)
    33-36 indicate transitions for low-cut and high-cut filters.
         For uncorrected (volume 1) time series provided by CSMIP, these four
            numbers indicate *suggested* transition bands to be used in the
            correction process.
         For corrected (volume 2) time series, these four numbers indicate
            the *actual* low-cut and high-cut filter transitions that were
            used in the correction process.
         The contents of real header cells 33 and 34 indicate the beginning and
            End of a transition band, in Hz, for a low-cut filter when the
            contents of 34 is positive.  When the contents of 34 is negative,
            however, its negated value indicates the roll-off parameter that
            was used in the BAP or AGRAM bi-directional Butterworth filter
            and the contents of 33 is the corner frequency, in Hz, that was
            used in the Butterworth filter.  (Note that the roll-off
            "parameter" indicated for the BAP & AGRAM Butterworth filter is
            equal to half of what is often called the "order" of a
            Butterworth filter.
         The contents of 35 and 36 indicate the beginning and the end of a
            transition band for a high-cut filter.
>>    >> IMPORTANT NOTE: If the contents of 33-36 are "undefined" in a Vol. 2
            or 3 file, the filtering scheme will be described in the comments
    37   Undefined
38    Initial value of the filtered velocity (cm/s) after a lo-cut filter has
         been applied to the integrated, baseline-corrected acceleration.
39    Initial value of the filtered displacement (cm) after a lo-cut filter has
         been applied to the doubly-integrated, baseline-corrected
         acceleration.
40    Vs30 in m/s
41-50 are undefined as yet.
```

3.4 Comments

Comment lines begin, by convention, with a "|" character in colume one and may be up to 80 characters long. The comments often provide references to published documents that describe the earthquake, station, or some other aspect of the record. Comments are also used to explain any peculiarities in the record, any difficulties in digitizing, and so forth, especially when integer header cell #18 (the problem flag) is set to one. In volume 2 files, the comments may provide information about the processing the time series has received.

The Comments may include text that can be used as top-of-plot labels when the time series in the file are plotted via the BAP or TSPLOT programs. These labels are indicated in the comments by a leading "<pltlbl=>" or "<loclbl=>" and a trailing "<end>". (Note that the <pltlbl=>, <loclbl=> and <end> must all be in lower case.) Both types of top-of-plot label can be more than one line long. Some sample comment lines that include top-of-plot labels:

```
| This time series was digitized at the USGS on 12dec97 by Sam Spade.
|   <pltlbl=> blah blah blah
|             any number of lines here
|             ending with:  <end>
|   <loclbl=> roof, north-west corner <end>
| More general comments here.
```

The <pltlbl=> top-of-plot label is usually just one line that indicates the address or name of the recording station, if sufficient station identification would not fit on line 6 (colums 11-40). The <loclbl=> label gives information about the location of the recording transducer. It is usually quite short, and in the case of tri-axial recordings it is usually absent because all three transducers are in the same location. The <loclbl=> information is provided separately from <pltlbl=> info so the info unique to each transducer is separate from the info several transducers share. (Makes construction the plot labels more convenient for the TSPLOT program.)

When integer header cell #33 is not "undefined", the second line of the comments (the first line is usually just "|") will indicate a text file that will provide information about the data in the current file. This feature was implemented for files from the California Strong-Motion Instrumentation Program (CSMIP) and will probably not be used in files from other sources. Integer header cell #16 indicates the number of comment lines in the file.

4.0 Time Series Files 8(1pe10.4e1) unless int_head(47)=8, in which case 5(e14.7)

Time-series values representing a single data trace from a strong-motion record follow the header lines in a time-series file. The Fortan format for each line is "(8(1pe10.4e1))" unless int_head(47)=8, in which case it is "(5(e14.7))". Eight (or five) values are given on each line, and there are as many lines as are required to provide the number of time-series values indicated in the value given in integer header cell #17. For unevenly-sampled

time series (real header cell #2 is "undefined"), the values are given as a series of time-acceleration pairs; for evenly-sampled time series the values are given as a series of evenly-sampled acceleration, velocity, or displacement values, with real header cell #2 indicating the sampling rate. The number of time-series "values" given in the file and indicated in integer header cell #17 is the number of samples if the time series is evenly sampled; twice the number of samples if the time-series is unevenly sampled (because two values, time and acceleration are given for each sample when the time series is unevenly sampled). Time is given in seconds, acceleration in cm/sec/sec, velocity in cm/sec, and displacement in cm.

5.0 Response Spectra Files

5.1 Description

```
Lines 1-30:  The first 30 lines of a response spectra file contain the header
               info that corresponds to the acceleration time series that was
               used as input to the response-spectra calculations. Header cells
               containing peak value, number of samples, and the like contain
               values appropriate for the acceleration time series.
Line 31:     indicates the units used for response values. The Fortran format
               for this line is "3(i2,a15)".
               The numbers and units are as follows:
               1 cm                          2 inches
               1 cm/sec                      2 inches/sec
               1 cm/(sec squared)            2 inches/(sec squared)
Line 32:     indicates the number of damping values, the number of period
               values, and a times-are-included-or-not flag. The Fortran format
               for this line is "(3i5)". The number of damping values is
               referred to as NDAMP below and is usually 5.  The number of
               period values (= the number of samples in each spectrum) is
               referred to as NPER below and is usually 91.  The whether or not
               (1 or 0) times of maximum response are included in the file flag
               is referred to as TFLAG below and is usually 0, indicating that
               times are not included. (The times of maximum response, lines
               43-48, are not provided in BAP output files, but they are given
               in some of the files that will be published in DDS#7 sequel
               CD-ROMs.)
-------------------------------------------------
The usage "Lines" below refers to *sets* of lines
-------------------------------------------------
Lines 33:    NDAMP/5 (rounded up) lines listing the NDAMP damping values in
               "(5e10.5)" format.
Lines 34:     NPER/7 lines listing the NPER period values in "(7e11.4)" format.
--------------------
Lines 35 through 48 are repeated for each NDAMP damping value:

Line 35:     A header card containing "Relative Displacement Response Spectrum
               at X% Damping" (where X is replaced by one of the NDAMP damping
```

```
              values).
Lines 36:    NPER/7 lines containing relative displacement response spectral
               values in "(7E11.4)" format.
Line 37:     A header card containing "Relative Velocity Response Spectrum
               at X% Damping"
Lines 38:    NPER/7 lines containing relative velocity response spectral
               spectral values in "(7E11.4)" format.
Line 39:     A header card containing "Pseudo-Velocity Response Spectrum
               at X% Damping"
Lines 40:    NPER/7 lines containing pseudo-velocity response spectral
               values in "(7E11.4)" format.
Line 41:     A header card containing "Absolute Acceleration Response Spectrum
               at X% Damping"
Lines 42:    NPER/7 lines containing absolute acceleration response spectral
               values in "(6E13.6)" format.
>>             >> Programmers please note the different format.

Lines 43 through 48 are given only when TFLAG=1:
-------------------
Line 43:      A header card containing "Times of Maximum Response Relative
               Displacement at X% damping"
Lines 44:    NPER/7 lines containing times of maximum response relative
               displacement in "(7E11.4)" format.
Line 45:    A header card containing "Times of Maximum Response Relative
               Velocity at X% Damping"
Lines 46:   NPER/7 lines containing times of maximum response relative
               velocity in "(7E11.4)" format.
Line 47:    A header card containing "Times of Maximum Response Absolute
               Acceleration at X% Damping"
  Lines 48   NPER/7 lines containing times of maximum response absolute
               acceleration in "(7E11.4)" format.
```

5.2 Sample Response-Spectra File

Here follows a sample BAP (version 2) response-spectra output file from which all but the first set of response spectra (the set corresponding to the first damping value) have been removed:

```
5 RESPONSE SPECTRA
*
DVD0D
     1989  10  18    0004 Loma Prieta, CA
Moment Mag=      6.9 Ms=      7.1 Ml=      7.0
station = Del Valle Dam, toe             component=     65
epicentral dist =     66.0       pk     =     53.7
inst type=SMA-1      data source = CDWR/USGS
*
*
*
    -32768      1989       291         0         4         0    -32768       451
         1         3         6    -32768        90        65       101         3
      5914    -32768         3    -32768    -32768    -32768    -32768    -32768
    -32768    -32768    -32768         1    -32768      1265    -32768    -32768
```

```
   -32768         1    -32768    -32768    -32768    -32768    -32768    -32768
   -32768    -32768    -32768    -32768    -32768    -32768    -32768    -32768
 0.1700000E+39  0.2000000E+03  0.3703700E+02 -0.1218830E+03  0.1800000E+02
 0.6900000E+01  0.7100000E+01  0.7000000E+01  0.1700000E+39  0.1700000E+39
 0.3761500E+02 -0.1217450E+03  0.1700000E+39  0.1700000E+39  0.1700000E+39
 0.1700000E+39  0.6600000E+02  0.1700000E+39  0.1000000E+05  0.5000000E+02
 0.5000000E+02  0.2564103E+02  0.6000000E+00  0.2000000E+01  0.1700000E+39
 0.1700000E+39  0.1700000E+39  0.1700000E+39  0.9790000E+01  0.5366566E+02
 0.9595000E+01 -0.4893999E+02  0.1000000E+00 -0.4000000E+01  0.1700000E+39
 0.1700000E+39  0.1700000E+39  0.1700000E+39  0.1700000E+39  0.1700000E+39
 0.1700000E+39  0.1700000E+39  0.1700000E+39  0.1700000E+39  0.1700000E+39
 0.1700000E+39  0.1700000E+39  0.1700000E+39  0.1700000E+39  0.1700000E+39
|
| test 1
|
 1 cm             1 cm/sec         1 cm/sec/sec
    5   91    0
    0.00000E+00    0.20000E-01    0.50000E-01    0.10000E+00    0.20000E+00
 0.4000E-01 0.4200E-01 0.4400E-01 0.4600E-01 0.4800E-01 0.5000E-01 0.5500E-01
 0.6000E-01 0.6500E-01 0.7000E-01 0.7500E-01 0.8000E-01 0.8500E-01 0.9000E-01
 0.9500E-01 0.1000E+00 0.1100E+00 0.1200E+00 0.1300E+00 0.1400E+00 0.1500E+00
 0.1600E+00 0.1700E+00 0.1800E+00 0.1900E+00 0.2000E+00 0.2200E+00 0.2400E+00
 0.2600E+00 0.2800E+00 0.3000E+00 0.3200E+00 0.3400E+00 0.3600E+00 0.3800E+00
 0.4000E+00 0.4200E+00 0.4400E+00 0.4600E+00 0.4800E+00 0.5000E+00 0.5500E+00
 0.6000E+00 0.6500E+00 0.7000E+00 0.7500E+00 0.8000E+00 0.8500E+00 0.9000E+00
 0.9500E+00 0.1000E+01 0.1100E+01 0.1200E+01 0.1300E+01 0.1400E+01 0.1500E+01
 0.1600E+01 0.1700E+01 0.1800E+01 0.1900E+01 0.2000E+01 0.2200E+01 0.2400E+01
 0.2600E+01 0.2800E+01 0.3000E+01 0.3200E+01 0.3400E+01 0.3600E+01 0.3800E+01
 0.4000E+01 0.4200E+01 0.4400E+01 0.4600E+01 0.4800E+01 0.5000E+01 0.5500E+01
 0.6000E+01 0.6500E+01 0.7000E+01 0.7500E+01 0.8000E+01 0.8500E+01 0.9000E+01
 0.9500E+01 0.1000E+02 0.1100E+02 0.1200E+02 0.1300E+02 0.1400E+02 0.1500E+02
 Relative Displacement Response Spectrum at 0.00 Damping
 0.2377E-02 0.2543E-02 0.3038E-02 0.3575E-02 0.3382E-02 0.4777E-02 0.4314E-02
 0.5028E-02 0.9993E-02 0.9882E-02 0.1041E-01 0.1224E-01 0.2071E-01 0.3067E-01
 0.1830E-01 0.3226E-01 0.5011E-01 0.1243E+00 0.1357E+00 0.5743E-01 0.1673E+00
 0.1294E+00 0.1139E+00 0.1969E+00 0.2241E+00 0.3555E+00 0.2864E+00 0.5695E+00
 0.1161E+01 0.6391E+00 0.1225E+01 0.1018E+01 0.1362E+01 0.1175E+01 0.1243E+01
 0.1429E+01 0.2087E+01 0.2259E+01 0.3183E+01 0.2130E+01 0.3379E+01 0.1563E+01
 0.1672E+01 0.1189E+01 0.2061E+01 0.1423E+01 0.1658E+01 0.1634E+01 0.5186E+01
 0.1919E+01 0.2479E+01 0.2162E+01 0.4273E+01 0.5399E+01 0.6623E+01 0.3094E+01
 0.4603E+01 0.4276E+01 0.4322E+01 0.4010E+01 0.6128E+01 0.4934E+01 0.3541E+01
 0.4295E+01 0.7949E+01 0.1273E+02 0.7865E+01 0.5489E+01 0.6737E+01 0.9248E+01
 0.1068E+02 0.1119E+02 0.1234E+02 0.1322E+02 0.1390E+02 0.1515E+02 0.2090E+02
 0.2475E+02 0.2396E+02 0.1871E+02 0.1583E+02 0.1267E+02 0.9982E+01 0.9011E+01
 0.8630E+01 0.8520E+01 0.8452E+01 0.8081E+01 0.7356E+01 0.6472E+01 0.6243E+01
 Relative Velocity Response Spectrum at 0.00 Damping
 0.1212E+00 0.1499E+00 0.1395E+00 0.1891E+00 0.1830E+00 0.5628E+00 0.1983E+00
 0.2080E+00 0.4809E+00 0.4814E+00 0.5238E+00 0.6912E+00 0.1158E+01 0.1610E+01
 0.7739E+00 0.1680E+01 0.2676E+01 0.6422E+01 0.6380E+01 0.2389E+01 0.6634E+01
 0.4553E+01 0.3653E+01 0.6406E+01 0.6822E+01 0.1103E+02 0.6910E+01 0.1434E+02
 0.2757E+02 0.1260E+02 0.2560E+02 0.1937E+02 0.2499E+02 0.1990E+02 0.2028E+02
 0.2198E+02 0.3094E+02 0.3165E+02 0.4298E+02 0.2788E+02 0.4234E+02 0.1787E+02
 0.1733E+02 0.1036E+02 0.1848E+02 0.1190E+02 0.1379E+02 0.1232E+02 0.3594E+02
 0.1215E+02 0.1558E+02 0.1220E+02 0.2265E+02 0.2522E+02 0.2873E+02 0.1261E+02
 0.1742E+02 0.1580E+02 0.1509E+02 0.1335E+02 0.1968E+02 0.1423E+02 0.9526E+01
 0.9296E+01 0.1855E+02 0.2689E+02 0.1576E+02 0.1024E+02 0.1215E+02 0.1587E+02
 0.1868E+02 0.1932E+02 0.1876E+02 0.1903E+02 0.1843E+02 0.1802E+02 0.2387E+02
```

```
0.2704E+02 0.2470E+02 0.2181E+02 0.1470E+02 0.1202E+02 0.1026E+02 0.9182E+01
0.8531E+01 0.8050E+01 0.7771E+01 0.7553E+01 0.7239E+01 0.7026E+01 0.6982E+01
Pseudo-Velocity Response Spectrum at 0.00 Damping
0.3734E+00 0.3805E+00 0.4338E+00 0.4883E+00 0.4428E+00 0.6003E+00 0.4928E+00
0.5266E+00 0.9659E+00 0.8870E+00 0.8721E+00 0.9615E+00 0.1531E+01 0.2141E+01
0.1210E+01 0.2027E+01 0.2862E+01 0.6506E+01 0.6561E+01 0.2578E+01 0.7008E+01
0.5081E+01 0.4209E+01 0.6874E+01 0.7411E+01 0.1117E+02 0.8181E+01 0.1491E+02
0.2806E+02 0.1434E+02 0.2566E+02 0.1999E+02 0.2517E+02 0.2052E+02 0.2054E+02
0.2245E+02 0.3123E+02 0.3226E+02 0.4347E+02 0.2788E+02 0.4246E+02 0.1786E+02
0.1751E+02 0.1150E+02 0.1850E+02 0.1192E+02 0.1302E+02 0.1208E+02 0.3621E+02
0.1269E+02 0.1558E+02 0.1235E+02 0.2237E+02 0.2609E+02 0.2973E+02 0.1296E+02
0.1808E+02 0.1580E+02 0.1509E+02 0.1326E+02 0.1925E+02 0.1409E+02 0.9270E+01
0.1038E+02 0.1784E+02 0.2666E+02 0.1544E+02 0.1014E+02 0.1176E+02 0.1529E+02
0.1677E+02 0.1674E+02 0.1762E+02 0.1806E+02 0.1820E+02 0.1903E+02 0.2387E+02
0.2591E+02 0.2316E+02 0.1680E+02 0.1326E+02 0.9948E+01 0.7378E+01 0.6291E+01
0.5708E+01 0.5353E+01 0.4828E+01 0.4231E+01 0.3555E+01 0.2905E+01 0.2615E+01
Absolute Acceleration Response Spectrum at 0.00 Damping
0.586592E+02 0.569191E+02 0.619419E+02 0.667019E+02 0.579564E+02 0.754375E+02
0.562953E+02 0.551417E+02 0.933705E+02 0.796204E+02 0.730636E+02 0.755151E+02
0.113180E+03 0.149468E+03 0.800518E+02 0.127345E+03 0.163497E+03 0.340677E+03
0.317104E+03 0.115684E+03 0.293558E+03 0.199548E+03 0.155571E+03 0.239955E+03
0.245069E+03 0.350862E+03 0.233638E+03 0.390300E+03 0.678083E+03 0.321824E+03
0.537479E+03 0.392569E+03 0.465161E+03 0.358056E+03 0.339700E+03 0.352583E+03
0.467172E+03 0.460627E+03 0.593806E+03 0.364929E+03 0.533611E+03 0.204018E+03
0.183377E+03 0.111121E+03 0.166061E+03 0.998630E+02 0.102268E+03 0.892970E+02
0.252773E+03 0.839396E+02 0.978758E+02 0.705356E+02 0.117139E+03 0.126110E+03
0.133409E+03 0.542793E+02 0.709874E+02 0.584107E+02 0.526669E+02 0.438574E+02
0.604844E+02 0.402444E+02 0.242684E+02 0.250856E+02 0.400264E+02 0.558439E+02
0.303220E+02 0.187444E+02 0.205212E+02 0.252825E+02 0.263497E+02 0.250426E+02
0.251648E+02 0.246734E+02 0.238196E+02 0.239180E+02 0.272721E+02 0.271371E+02
0.223843E+02 0.150756E+02 0.111084E+02 0.781279E+01 0.545407E+01 0.439177E+01
0.377497E+01 0.336362E+01 0.275777E+01 0.221554E+01 0.171830E+01 0.130361E+01
```

6.0 Fourier Spectra Files

My program smc2fs2 can write the Fourier spectra to a file using smc format, where the response spectra format is used. My program asc2smc knows how to read this format and to construct an array of frequency from header information in the smc file.