

USERS'S GUIDE TO

TF_MISFIT_GOF_CRITERIA

Computation of the Time-frequency Misfit and Goodness-of-fit Criteria
for Comparing Time Signals

The Fortran95 Code

by

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Introduction

Purpose: The program TF_MISFITS_GOF_CRITERIA is designed for computation of the time-frequency misfit and time-frequency goodness-of-fit criteria

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Availability and use of the program:

Program is downloadable from
http://www.nuquake.sk/Computer_Codes/

Reference to the program:

The user is asked to make reference to

Kristekova, M., Kristek, J., Moczo, P., Day, S. M., 2006. 
Misfit Criteria for Quantitative Comparison of Seismograms.
Bull. Seism. Soc. Am. 96(5), 1836-1850, doi: 10.1785/0120060012.

Kristeková M., Kristek J., Moczo P., 2009. 
Time-frequency misfit and goodness-of-fit criteria
for quantitative comparison of time signals.
Geophys. J. Int. 178, 813-825, doi: 10.1111/j.1365-246X.2009.04177.x.

Acknowledgements:

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Input files

Program TF_MISFIT_GOF_CRITERIA requires these input files:

- an auxiliary file containing input parameters for the computation,
- a file containing the first signal to be compared
- a file containing the second or reference signal to be compared

Auxiliary file 'HF_TF-MISFIT_GOF'

The file type is ASCII and contains several control parameters.

NAMelist /INPUT/ S1_NAME, S2_NAME, NC, MT, DT, FMIN, FMAX, &
IS_S2_REFERENCE, LOCAL_NORM

<i>Name of Variable</i>	<i>Type</i>	<i>Description</i>
S1_NAME	A20	the name of the file containing the first signal
S2_NAME	A20	the name of the file containing the second or reference signal
NC	integer	the number of components of each signal <i>default: NC = 1</i>
MT	integer	the number of time samples of each signal
DT	real	time step in seconds
FMIN, FMAX	real	minimum and maximum frequency in Hz defining the desired frequency range in which the misfit criteria will be calculated the frequency range is (automatically) sampled logarithmically equidistant
IS_S2_REFERENCE	logical	.TRUE.: signal S2 is taken as reference signal .FALSE.: none of two signals is considered a reference <i>default: IS_S2_REFERENCE = .FALSE.</i>
LOCAL_NORM	logical	.TRUE.: TF Misfit and GOF Criteria are locally normalized .FALSE.: TF Misfit and GOF Criteria are globally normalized <i>default: LOCAL_NORM = .FALSE.</i>

Input data file *S1_NAME*

The file type is ASCII and contains the first signal.

The data is read by

```
DO I = 1, MT
  READ (10,*) TIME, ( S1 (J,I), J = 1, NC )
END DO
```

Input data file *S2_NAME*

The file type is ASCII and contains the second or reference signal (depending on the variable *IS_S2_REFERENCE*).

The data is read by

```
DO I = 1, MT
  READ (10,*) TIME, ( S2 (J,I), J = 1, NC )
END DO
```

Output files

Program *TF_MISFIT_GOF_CRITERIA* generates several output files:

- two files named 'S1.DAT' and 'S2.DAT' containing input signals (as read by the program),
- a file containing the input parameters (as read by the program) and single-valued time-envelope and phase misfit and goodness-of-fit criteria,
- a file containing the TF envelope misfit,
- a file containing the TF envelope goodness-of-fit,
- a file containing the TF phase misfit,
- a file containing the TF phase goodness-of-fit,
- a file containing the time-dependent envelope misfit,
- a file containing the time-dependent envelope goodness-of-fit,
- a file containing the time-dependent phase misfit,
- a file containing the time-dependent phase goodness-of-fit,
- a file containing the frequency-dependent envelope misfit,
- a file containing the frequency-dependent envelope goodness-of-fit,
- a file containing the frequency-dependent phase misfit,
- a file containing the frequency-dependent phase goodness-of-fit,
- a file containing the TF representation of the first signal,
- a file containing the TF representation of the second signal.

Output data file 'MISFIT-GOF.DAT'

The file type is ASCII and contains the control data and single-valued envelope and phase misfit and goodness-of-fit criteria.

```

WRITE ( 21, *) FMIN, FMAX
WRITE ( 21, *) NF_TF, MT
WRITE ( 21, *) DT, NC
WRITE ( 21, *) MAX(MAXVAL(ABS(S1)), MAXVAL(ABS(S2)))
DO J = 1, NC
  WRITE ( 21, *) EM(J), PM(J)
END DO
DO J = 1, NC
  WRITE ( 21, *) EG(J), PG(J)
END DO
WRITE ( 21, *) MAXVAL(ABS(TFEM)), MAXVAL(ABS(TFPM))
WRITE ( 21, *) MAXVAL(ABS(FEM)), MAXVAL(ABS(FPM))
WRITE ( 21, *) MAXVAL(ABS(TEM)), MAXVAL(ABS(TPM))
WRITE ( 21, *) MAXVAL(ABS(TFRS1)), MAXVAL(ABS(TFRS2))

```

<i>Name of Variable</i>	<i>Type</i>	<i>Description</i>
FMIN, FMAX	real	minimum and maximum frequency in Hz defining the desired frequency range in which the misfit criteria will be calculated the frequency range is (automatically) sampled logarithmically equidistant
NF_TF	integer	the number of frequency samples of the computed time-frequency and frequency-dependent misfits
MT	integer	the number of time samples of each signal
DT	real	time step in seconds
NC	integer	the number of components of each signal
S1, S2	real	arrays containing the S1 and S2 signals
EM	real	single-valued envelope misfit EM
PM	real	single-valued phase misfit PM
EG	real	single-valued envelope goodness-of-fit EG
PG	real	single-valued phase goodness-of-fit PG
TFEM	real	time-frequency envelope misfit TFEM
TFPM	real	time-frequency phase misfit TFPM
FEM	real	frequency-dependent envelope misfit FEM

<i>Name of Variable</i>	<i>Type</i>	<i>Description</i>
FPM	real	frequency-dependent phase misfit FEM
TEM	real	time-dependent envelope misfit TEM
TPM	real	time-dependent phase misfit TPM
TFEG	real	time-frequency envelope goodness-of-fit TFEG
TFPG	real	time-frequency phase goodness-of-fit TFPG
FEG	real	frequency-dependent envelope goodness-of-fit FEG
FPG	real	frequency-dependent phase goodness-of-fit FEG
TEG	real	time-dependent envelope goodness-of-fit TEG
TPG	real	time-dependent phase goodness-of-fit TPG
TFRS1	real	time-frequency representation of the first signal
TFRS2	real	time-frequency representation of the second signal

Hereafter the '**x**' will stand for the number of the component.

Output data file 'TFEMx.DAT'

ASCII file containing values of the time-frequency envelope misfit

```
DO L = 1, NF_TF
  WRITE ( 21, * ) ( TFEM(x,I,L), I = 1, MT )
END DO
```

Output data file 'TFEGx.DAT'

ASCII file containing values of the time-frequency envelope goodness-of-fit

```
DO L = 1, NF_TF
  WRITE ( 21, * ) ( TFEG(x,I,L), I = 1, MT )
END DO
```

Output data file 'TFPMx.DAT'

ASCII file containing values of the time-frequency phase misfit

```

DO L = 1, NF_TF
  WRITE ( 21, * ) ( TFPM(x,I,L), I = 1, MT )
END DO

```

Output data file 'TFPGx.DAT'

ASCII file containing values of the time-frequency phase goodness-of-fit

```

DO L = 1, NF_TF
  WRITE ( 21, * ) ( TFPG(x,I,L), I = 1, MT )
END DO

```

Output data file 'TEMx.DAT'

ASCII file containing values of the time-dependent envelope misfit

```

DO I = 1, MT
  WRITE ( 21, * ) TEM(x,I)
END DO

```

Output data file 'TEGx.DAT'

ASCII file containing values of the time-dependent envelope goodness-of-fit

```

DO I = 1, MT
  WRITE ( 21, * ) TEG(x,I)
END DO

```

Output data file 'TPMx.DAT'

ASCII file containing values of the time-dependent phase misfit

```

DO I = 1, MT
  WRITE ( 21, * ) TPM(x,I)
END DO

```

Output data file 'TPGx.DAT'

ASCII file containing values of the time-dependent phase goodness-of-fit

```

DO I = 1, MT
  WRITE ( 21, * ) TPG(x,I)
END DO

```

Output data file 'FEMx.DAT'

ASCII file containing values of the frequency-dependent envelope misfit

```
DO L = 1, NF_TF
  WRITE ( 21, * ) FEM(x,L)
END DO
```

Output data file 'FEGx.DAT'

ASCII file containing values of the frequency-dependent envelope goodness-of-fit

```
DO L = 1, NF_TF
  WRITE ( 21, * ) FEG(x,L)
END DO
```

Output data file 'FPMx.DAT'

ASCII file containing values of the frequency-dependent phase misfit

```
DO L = 1, NF_TF
  WRITE ( 21, * ) FPM(x,L)
END DO
```

Output data file 'FPGx.DAT'

ASCII file containing values of the frequency-dependent phase goodness-of-fit

```
DO L = 1, NF_TF
  WRITE ( 21, * ) FPG(x,L)
END DO
```

Output data file 'TFRS1_x.DAT'

ASCII file containing values of the modulus of the TF representation of the first signal

```
DO L = 1, NF_TF
  WRITE ( 21, * ) ( TFRS1(x,I,L), I = 1, MT )
END DO
```

Output data file 'TFRS2_x.DAT'

ASCII file containing values of the modulus of the TF representation of the second signal

```
DO L = 1, NF_TF
  WRITE ( 21, * ) ( TFRS2(x,I,L), I = 1, MT )
END DO
```