SYNCHRO Toolbox for MATLAB

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Main Functions

- **synchroIRP.m** calculates from a two column .txt or .csv file (one time-series per column) the mean and SD period and amplitude for each time-series, the circular mean, SD, and resultant vector (r) of the instantaneous relative phase (using the Hilbert transform) between the two time-series, the 0-180 and/or -180 to 180 distributions of relative phase between the two time-series, and the average cross-spectral coherence between the two time-series. All of these measures can be output to a summary file.

- **synchroDRP.m** calculates from a two column .txt or .csv file (one time-series per column) the mean and SD period and amplitude for each time-series, the circular mean, SD, and resultant vector (r) of the discrete relative phase (using the Hilbert transform) between the two time-series (using the column one time series as the referent), the 0-180 and/or -180 to 180 distributions of relative phase between the two time-series, and the average cross-spectral coherence between the two time-series. All of these measures can be output to a summary file.

- **synchroBatch.m** calculates and outputs all of the above IRP or DRP measures on a batch of selected continuous two column .txt or .csv data files.

Sub-Functions

- **hilbertphase.m** calculates instantaneous relative phase between two time-series (using the Hilbert transform). Returns the instantaneous relative phase time-series in radians, the circular mean and SD of the relative phase in radians, and the mean resultant vector (rvRP = 0 to 1).

- **discretephase.m** calculates discrete relative phase between two time-series, with time-series 1 peaks as the referent. Returns the discrete relative phase time-series in radians, as well as the circular mean and SD of the discrete relative phase in radians and the mean resultant vector (rvRP = 0 to 1).

- **coherence.m** calculates the average cross-spectral coherence at the fundamental frequencies of the two time series. Outputs mean coherence and the coherence at each fundamental frequency, as well as the power/frequency functions for each TS and the cross-spectral coherence analysis.

- **period.m** Returns the peaks and peak locations for rhythmic time-series data, as well as the mean period and SD period in seconds.

- **amplitude.m** Returns the peaks and valleys and peak and valley locations for a rhythmic positional time-series, as well as the mean and SD amplitude.

- **returnPlot.m** calculates the discrete relative phase between two times series and plots the RP_t to RP_{t+1} relative phase on a return plot. Great for determining if coordination is polyrhythmic (i.e., 1:2, 2:3, etc).

Toolbox Example Data Files

- **ExData_Inphase.csv** two columns of rhythmic arm movement data (continuous inphase movement data) recorded at a samplerate of 60 Hz.

- **ExData_Inphase.csv** two columns of rhythmic arm movement data (continuous antiphase movement data) recorded at a samplerate of 60 Hz.

- **ExData_Intermit.csv** two columns of rhythmic arm movement data (continuous data, intermittent coordination) recorded at samplerate of 60 Hz.

- **ExData_TwoToOne.csv** two columns of simulated data that have a 2:1 relationship, simulated at a samplerate of 100 Hz.

- **ExData_ThreeToTwo.csv** two columns of simulated data that have a 3:2 relationship, simulated at a samplerate of 100 Hz.

Example Syntax (copy a line into the command window in MATLAB)

```
>> synchroIRP('ExData_Inphase.csv', 60, 1, 1, 2);

>> synchroIRP('ExData_Antiphase.csv', 60, 2, 1, 2);

>> synchroIRP('ExData_Intermit.csv', 60, 1, 1, 2);

>> synchroDRP('ExData_Inphase.csv', 60, 1, 1, 2);

>> synchroDRP('ExData_Antiphase.csv', 60, 2, 1, 2);

>> returnPlot('ExData_TwoToOne.csv', 100);

>> returnPlot('ExData_ThreeToTwo.csv', 100);
```