Bind deconvolution via maximum cyclostationarity
Matlab documentation

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Folder contents and file descriptions

`MaxCycloBD.m`	This function performs the blind deconvolution of signal x for a single-input-single-output system by finding the optimal inverse filter (FIR form) that maximizes the cyclostationarity of the output.
`MaxCycloBD_SIMO.m`	This function performs the simultaneous blind deconvolution of multiple signals x for a single-input-multiple-output system by finding the optimal inverse filters (FIR form) that maximizes the cyclostationarity of the output.
`MaxCycloBDangle.m`	This function performs the blind deconvolution of signal x for a single-input-single-output system by finding the optimal inverse filter (FIR form) that maximizes the cyclostationarity of the output through a weighting matrix defined in the angle time/angle domain.
`demo_CYCBD.m`	This interactive script shows six different applications of the previous functions, extracting cyclostationary sources from noisy observed signals and considering different interferences.

Syntax

```
% [h,s,kappa,count,err] = MaxCycloBD(x,N,alpha,fs,param,p)
% SISO BLIND DECONVOLUTION VIA MAXIMUM CYCLOSTATIONARITY
%  Blind deconvolution of signal x by finding the optimal inverse filter (FIR form)
%  that maximizes the cyclostationarity of the output.
%
%--------
% Inputs
%--------
%
% x.........observed signal
% N.........FIR filter length
% alpha.....cyclic frequency set (in the form of a vector)
% fs........sampling frequency of x
% param.....structure of setting parameters organized as follows:
%                param.ER......minimal relative error on result (default value = 1e-3)
%                param.iter....maximum number of iterations (default value  = 50)
% p.........cyclostationarity order to maximize (default = 2)
%
```

```
%---------
% Outputs
%---------
%
% s.........blindly deconvolved signal
% h_final...optimal inverse FIR filter at convergence
% kappa.....value of criterion at convergence
% W.........weights used in the criterion at convergence
% count.....number of iteration to convergence
% err.......relative error on result as a function of iterations

% [h,s,kappa,W,count,err,extr] = MaxCYCBD_SIMO(x,N,alpha,fs,param,h,p)
% SIMO BLIND DECONVOLUTION VIA MAXIMUM CYCLOSTATIONARITY
%  Simultaneous blind deconvolution of multiple signals x for single-input-multiple-output systems
%  by finding the optimal inverse filters (FIR form) that maximizes the cyclostationarity of the c
%
%--------
% Inputs
%--------
%
% x.........observed signals of length L organized as a matrix LxK where K
%           is the number of observed signals
% N.........FIR filter length
% alpha.....cyclic frequency set (in the form of a vector)
% fs........sampling frequency of x
% param.....structure of setting parameters organized as follows:
%                param.ER......minimal relative error on result (default value = 1e-3)
%                param.iter....maximum number of iterations (default value  = 50)
% p.........cyclostationarity order to maximize (default = 2)
%
%---------
% Outputs
%---------
%
% s.........blindly deconvolved signal
% h_final...matrix of N-long optimal inverse filters stacked in K columns
% kappa.....value of criterion at convergence
% W.........weights used in the criterion at convergence
% count.....number of iteration to convergence
% err.......relative error on result as a function of iterations

% [h,s,kappa,count,err] = MaxCycloBDangle(x,N,alpha,fs,param,p)
% SISO BLIND DECONVOLUTION VIA MAXIMUM CYCLOSTATIONARITY (ANGLE/TIME DOMAIN
% VERSION)
%  Blind deconvolution of signal x by finding the optimal inverse filter (FIR form)
%  that maximizes the cyclostationarity of the output through an weighting matrix
%  defined in the time/angle domain.
%
%--------
% Inputs
%--------
%
% x.........observed signal
% N.........FIR filter length
% alpha.....cyclic order set (in the form of a vector)
% fs........sampling frequency of x
% tPulse....time occurrences of the angular reference
```

```
% Npulse....number of occurrences per revolution
% param.....structure of setting parameters organized as follows:
%                param.ER......minimal relative error on result (default value = 1e-3)
%                param.iter....maximum number of iterations (default value  = 50)
% p.........cyclostationarity order to maximize (default = 2)
%
%---------
% Outputs
%---------
%
% s.........blindly deconvolved signal
% h_final...optimal inverse FIR filter at convergence
% kappa.....value of criterion at convergence
% W.........weights used in the criterion at convergence
% count.....number of iteration to convergence
% err.......relative error on result as a function of iterations
```

Demo usage

The interactive demo can be launched by running the m. file `demo_CYCBD.m`.

Reference

[1] M. Buzzoni, J. Antoni and G. D'Elia, "Blind deconvolution based on cyclostationarity maximization and its application to fault identification", Journal of Sound and Vibration, 2018, *Accepted*.