
Subject: EOF Analysis

Posted by [B}rd Krane](#) on Fri, 09 May 1997 07:00:00 GMT

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Recently I received an email Julian Castaneda with questions about Empirical Orthogonal Functions. Unfortunately the reply address was bogus and my reply just bounced. I am quite sure my name was obtained from one of my postings in this newsgroup and as a last try I post my reply here.

;Dear Julian

;I am still fairly new to Singular Value Analysis, or EOF, but

;perhaps these references could be of interest:

;

; Roberts, R. A and Mullis, C. T.

; "Digital Signal Processing",

; 1987 Addison-Wesley, pp 538-542

; ISBN: 0-201-16350-0

;

; Johnson, D. E. and Dudgeon, D. E.

; "Array Signal Processing; Concepts and Techniques",

; 1993 Prentice-Hall, 496-497

; ISBN: 0-13-048513-6

;

;I guess you obtained my name from the IDL-PVWAVE newsgroup and I

;therefore include a little code fragment in IDL. If you prefer other

;programming languages I would recommend the Numerical Recipes since

;the IDL-code is based on this book.

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; --- IDL Code ---

N = 32 ; Spatial Resolution

M = 64 ; Temporal Resolution

x = 2.0*!pi*findgen(N)/N ; 0 <= x < 2pi

t = findgen(M)/M ; 0 <= t < 1.0

x = x # (fltarr(M)+1.0) ; Create a NxM matrix

; with an outer product

t = (fltarr(N)+1.0) # t ; This one is also NxM

; Try this out for different Signal to Noise ratios and

; see the effect on the distribution of Singular Values

A = sin(x)*sin(2.5*!pi*t) + 0.5*randomu(seed,N,M) ; Standing Wave +

```

Noise
A = sin(x+2.5*!pi*t) + 0.5*randomu(seed,N,M) ; Propagating Wave +
Noise

svdc,A,W,U,V ; Singular Value
Decomposition ; Check the IDL Manual

idx = reverse(sort(W)) ; Sort the singular
values
W = W(idx) ; according to size
V = V(idx,*)
U = U(idx,*)

K = n_elements(where(W GE 0.1*W(0))) ; Decide how many terms
to ; use in the
reconstruction
B = fltarr(N,M)
FOR i=0,K-1 DO $ ; Reconstruct with K
terms
    B = B + W(i) * reform(V(i,*) # reform(U(i,*))

window,1,retain=2
!p.multi = [0,3,1]
!x.style = 1
!y.style = 1

contour,A,nlevels=12,title="Sampled Data"
contour,B,nlevels=12,title="Reconstructed Data"
plot,w/w(0),yrange=[0.01,2.0],/ylog,psym=2,title="Singular Values"

end

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