25/04/2024

Thursday.

Unit-v

the Spectral density

Power Spectral density fr:

&

ملك

or mabnat

If {x (1)} is a Stationary process elther in the Strict Sense or WSS) with auto correlation fin. of R(T) then the fourier transform of R(T) is called

the

ль

pouser Spectral density for- of { x(t)} and is t denoted by;

Sxx **(w**) (or) Sx (w) (or) S (w) to A

Sw)= [R(T)e-iwr dr. ?[^] A

[x] 4

[x] 4

Given

а

рошич

Spectral density for.

`S

S(w), the auto

carrelation fr. R(*T*) is given by the Inverse

Fourier transform of REA

TR

ie., R*(*T)

=

+ √ √ (w) e

~iwt dw.

2п

If x(t) **and** y (t) are two jointly Stationary random process with cross correlation fr; Rxy (c), then the fourier transform of Rxy, (c) is called the cross power Spectral density of {x(t)} and {'*ÿ (+)}*

and is Sxy (w).

C

Sxy **(**∞) = | Rxy (wo) e

-ίωτ

-iwt de

dr

28

[03 x]

26/04 Friday.

Properties of Powier, Spectral density fr:.

*1.* / The value of Spectral: density for at Zero frequency

is Equal to the total area under the graph of

auto correlation func.

**τ**

tun with han utumb

(w}& = (w)\*2

area under the graph of Spectral density fr:

0402

S' (D) of R*(*T). dt.

When do the total

*2.* The mean

Square

lue o wss Process

May my fan et

.

\* [x2(t)] = R(0) = [S (f.)

df..

real random

fn2 of a

PX

X (W) pX FI

pouf handlet avvert

habok hits sing

بداند داین

3. The Power Spectral density, In; **of**

an even

Process is Processive

S 8(*w)* 11. *8 (20*) = 3(22)

Proof:

S(w) =

∞

fn.

80038306

have on and of Cons ple Jo warehen 1 (0)84 pounds Joway?

Liw z dr

I R (t) e d

S[-w) - Ï° R(T) e

Let

**=**

-

duz-dx.

1

∞

*iw* z dz

to ∞

(س)

x= ∞ to 20 votation alue wit

8(-w) - [R (t) e = iwx (\_dx)

∞

A3

iwx dx

Q

champile apppdate

R(T)e

(

S(W)

、,

phurch lestiegs sung

S(-w)

J R

=

x

The Spectral density of fr. of

ia Process { x(t)}

со

real or complete is a real foi of co is lov

non-

2-negative.

for

show "sana datal will at

S\*(w) = S(w); S(w) 20

Jaupth

il vintalawan,

I

5. The Spectral density and the auto correlation **fr**. of a real wuss process form a Fourier cosine

**transform** pair.

6. Wiemer - Khinchine

theorem

༨༤ ང AURAN

If XT (W) is the *F. T.* of the truncated random ]

pracers defined by Xq (t) = *(*x*(*t);

Хт

real

1±1 ≤T

‚!!$!Â!O

70*;* [t] >T.

where { XT (w) } is a Spectral density fr. 8(w). then;

S(w*)* = Lt √ 1 k [XT

T700

PROBLEMS:

{

27

process

with

рошеч

War!

(u)18

= (0)8

8-21*/*71

J-22EL tat

1. The auto correlation fn of the random"

30

telegraphical Process is given by R (T) = & Determine the Power Spectral density of the random

007

(-) &

**telegraph** Signal.

Soln:

*ginen*

R(t)= 1-217 50.

(0) A

To *find* S(W)=?

The

pouur

Spectral density fn;

(4-38

∞

S(w)= | R(T) e-iwr *dr*.

B-

10

ωτ

Je-all [ Cos WT

-∞

е

21

е

-

217

a

Enen

Coswi dr.

b

41

alien (21)2 + wa

47 248 2

ωτ

iSinwt] dww

odd

-ax Cosbx dx

[Je-a

**a**

a2+62

rays jumal alb Jua? f

a

S(w)=-41.

410+w2.

131

2. Find the power Spectral density of

a wss process

-ατά

with the auto correlation fn." R(z) = eat?

Soln: ginem R(T) =

= e

1

9726

(0-3 (0)8

Job..

= 2

To fund S (*W)* = ? huh.

S

Ζωτ

-

i

iwr dr.

3 (0) - JR(E) - for dr. - Jekthe for

∞

e

2

=*/*e-(at 2 + iwr) dr.

**∞**

е

2ίωτ

72 + 2iwT

して

-je-a/72

J.

a

*2d*

Jd=

- *Je-α [72* + à (fur)

**-∞**

∞

J

b

**-∞**

e

е

*\_a*(7+

*wa*/4d2

e-w2/40&

∞

е

*i*

2

-

2d

e

1

wa tik

7122

~~

w2

الدان

J

dr.

1

JJ

422

i ft + iwr ja dr.

22

-x2 (√x dx)

**e**

Let x

T= √a (t'+ iwe)

dx=fade.

2

da

"dx = √π

ཤ་༢༢

22

= e

-

wa/4d2

x b x d z √a

S. (w)

~ 2 dx

wa

e

**4α2**

3. Find the Power Spectral density of the bimary**.**

random binary

transmission process "whose auto

1- ITI (21 3T - (62

correlation fn is; R*(T)*

32W

Soln: To find S.*(w)* = ?

T

0

عد لحمل

adstar

S(W) = Ï R(T) **e** iwr dr.

T

· To+ √(1 = (1) e

T

-T

**Ф**

-T

J

J

ζωτ

otherwise.

sawng at brat atun at them.

∞

de + √(9) & Janet of

rb wi

T

2. (~]$ [+ (40) 2

(1-1) [

Coswr - iSinwT*]d* T

뚜[ Even (odd

T

Coswr

ωτ

a] (1-4) Casas dr

2

*и*

Using bernoullis formula; Juvdx = uv, -u'v2 + u "V

u = 1/

-

Twis

ゴ

V= COSWT

SinwT JW3

门

u'

***2***

TH

I

δίπωτ

**ω**

ω

V1

درود

Coswi

w2.

Coswi

w2

= **a**[0 - COSET -0 + 117]

÷

602

**соят**

J

T

2.

S(W) = **2**:

Τω Σε

(1=CoSWT*)* = 2

Twa

(2 Sin2 67)

T

O4. If the

given by S (10)

4.

Tw2

·

power Spectral density of

= { ++

*Sin* 2 *WT*

2

A

WSS Process is

(a-1w1)*;* (w/ s a

206" (w/>a.

Find the auto correlation for

of

the Process.

Soln:

given S (w) - {

b

(a-/w1); /w/ a d

=

0

(w/> a 50A

The auto correlation for R*(*T*)* is given by;,

денет

STOT

R(T) = -1 [S (w)] = teh, dantreyle serenest wit

R(T) *=*

**2л**

o Roft) x 1] 0, +

X

b

**па**

27

a

!

***a***

Î

[S(W)

S(w)*&*

**a**

e

iwr do {(u]

1

034 8200

olds fie lewe dw't I

*τ*

∞

27 ) + ( a - /w 1) e lir du t↓ (e) 2.

b

2л

1 1⁄2

\_a

**a**

a

11⁄2 (+) X to At wed?

*(a*-1601)

[

***a***

Coswt + i Sinwz] dw it

Even

[G] x]

b (*a-*w) Coswordw..

a

asugpodto

(a-w) Coswe *dw*

V

Using Bernoullis formula;

Juvdx = uv, -u'v2 +u,

u = a-w

u'=~|

u" = 0

*V* COSWT

V2 =

Irk Sin wr

-

て

Cos ωτ

z 2

odd

(a) 2

~ (0)8

(~~) A

AR

X

=

b

Па

b

[(a-w*)*

[

**D**

ña La

b

патя

5

Tw e

-

Sinwz

て

Cosaz

8872

-

(1- Cosaz)

b= 2 Sind az

22.

πατα

<169

+(+1)/*+* COSUUT

**a**

+(+1) ( + (

0+

za

210-03

R(t) = 26 Sin 2 *az*

Tara

2

ง

72

(*(*1 - Coso = 28m20).

(w)2

ad bmat

مسلة

a. Zero mean!!

**а**

5. The Power Spectral density fri of a. wss process o{ **x** [**t)**} is genem by; S(W) Sk Thil w/ < Wo

{

O otherwice) 4

(-) X

Find "R(t) and Show that *x(t)* and x ( + + π/wo) cead are

uncorrelated.

£ [x(±)] = 0.

Soln:

given;

S(w) =

2

;

0

;

(1w1-0)

/ w/ Wors) (0)

otherwise.

R(T) = 1/1 | 8(w) e

R(*T)*

41

2л

2л

изо

Wo

-wo

1.e

d

iWT dw?) (0-0)

3

(alumnof allsoused pricall

iwr dwi

Tw36)

an [(Coser +

"CoSWT + iSinior) dw

Ял

..

2л

*-* из

D

wo

Even

Cos we dw

odd

C

xbyw |

W3-013

ل

IT

시

Wo

R(t) = [ Sinwe ] + Sinus T. [p \* [mg=81] Y

т

τ

=

& Lad-X1]

τ

R (T) = £ [ x (+). *E [×*

(t + c)]

£ [x (+)] • & [ x

(

+

+

1 ) ] = R(A)

-

шо

I Sin wy (10)

πT

[Sink=0]

= -0*.*

£[x(b)].ε [x(+)]..

C[£[×(4)]-£[×(& + ^*/wo)]* = [[x(4)]. \*

*Cov (x(*t), × (t + 1/wo)] = E *[×* (+)]. £ [x (±‡ \*/wo*)]*

x

E :\* [x *(at*) *\*\* [*x (at + "/wo)

.: x(t*)* & X (t + π/wo)

are uncorrelated*.*

#DI YCE)

Ryy(t)

x(E+a)-x(t-α)

prove that

2 Rxx (z) = Rxx (T+2a) -Rxx (Z-2a) and

Hence prove that Syy (c)

sam:-

Syy (w) = 4 sin2 (aw), Sxx(w) •

WIKT Rxx (z) = E[x(t) •x (t+x)]

giver

YCE) = x (t+a) − x (t-a)

-

Ryy(z) == √(x(t1a) = x(+-a)]• [*x*(€+a+t) −xce-a+t]}

J

Aet

E

-

Ex(t+a) = x(t+a+c)− x (t+a)。 x(t−a‡T) —

-

•ate)}

~x (t-a)• ×(€+a+z) + x(t-a)• x(t+a+c

-

E{x (€+a) • x (t+a$Z)

(t+a) • x (t+a¥7) −x (t+a). x (t+a-29+7) - x(txa)+x(+-a+2a+7) + x (t-a) •x(t-a+c)}

Z=t+a

& u=t-a

=`E [ × (Z) -×(z+7)] ~ E [× (z)• x(z=2a+<)]

-=[×(4) ·*x(*4+2a+c)] + [x(a)•x(4+2)]

=

Rxx (z) - Rxx ((-2a) - Rxx (z+2a) + Rxx (Z)

xx(z) - Rxx ((+29)

WIKT

= 2

-∞

-Rxx (t-2a).

Syy (w) = √ Ryy (T) = level

Last

Rxx

-

2

dc

S Rxy ((+29)ē de-

iwe

iwe

-S2 Rxx (2-29) ĕtore de

let

4=2+2a & V = T-2a =1+29

(T=4-29)

= 2 S (W)-SR xx

(a) wc

w(u-20)

du

-

SB

(V)

له.

=.2 Sx (W) = é

(ها)

iw29

-

S Rxx

།།

*e*

2 Sxx (w) - jwza

= 25xx (0) - S

28

Lica

xx

Liwza

4༥་ e

S (w) -izaw

xx

Sxx (as)

++ (w) [@saico - Daiw]

+

25+ (w) - St (w) 2 cos (2aw)

xx

xx

=25(W) (1- cos zaw]

له

i∞ (V+29) dv

xx

dv

io io

(ie te=26050)

(1-60520=2595g)

(ay=2Sxx (w) 2 sin2 (ac)

sinaco)

Hence

proved.

Find the auto correlation Pn. of a random

Process {X()} if

10/1

;

otherwise

Son: given Sxx

Sxx (W)

=

༑ "

ᅲ

; otherwise

Rxx(t)

((x) === √ Sxx (as) a

21T

ग्रा

217

$

له

jiwe

дая

dw

(coswe+isinwt) des

even

odd

•

Co cut dow =

[Sinwe) = sint

て

て

If

Rxx(t) =

{

$1-171; 121≤1

Find power spectral

; otherwise

density

of X(E)•

soni-

given Rxx (D)

=

{

81-121

Sxx (W) =

SR

ХХ

xx(E)

de

Using

(z) ĕtwe

! otherwise

S (1-171) (Goswe -i sincejde

- 2 2 S'(1-2) coswe de

bernoulli's formula,

Suvda = ur1-u'v2 tee**"**

sinwe-odd inte,

30

U=1-2

al

V= Caswe

Sinwe

W

V

C

Cosure

632

[(1-T) sme since) - (+1) (+ coswe

250 Casco ယ

-----

2012

22 (1-cosw)

0+12]

(~ COSWE)]'

3 xinx = (sintx))"

일

2

घर

2 2 32

Acid

given the PSD Sx (w)*=*

w3+2

Find the average power"

W2+1342+36

solt:-

given

(80) =

Xx

(w29) (w2+4)

Let co2=u

2

Sxx(es) = 4+2

A

(4+9) (4+4) (ata)

(+9)

w2+2

36

人

94

B

+

multiply (U+9) (4+4) on both sides,

4+2=

A (4+4)+B (a+9)

But Ul=-&

but 4=-9 →

(4+4)

−4+2=A(0) + B (-4+9) ⇒ 5B =-2

-9+2 = A(−9+4)+ B(0) = -5A=-7

AB value in ean R

S(W) =

**Ca**

= (19) 20 (1)

44

Rxx(T) = F'[S(w)] = = [(+3)+2 (12.)

W.KT

二口

ža éales

WIFT F'[=a] ===

그

Rxx (z) = = == 2(3)

5

3

2181

03121

뜸 (2)

**e**

to

хх

Rx (z) = = =?!?!

The

30

average

Power

C

02121

Rxx (0)

Rxx (0) = 2/15

131

B=

A=7/5

7-3

=

4

30

30

Problem under given: S(W), To find R(C) and mean square value

Formula:

4

× **F**[] = a calzi

T

*\**

R

[(1+W2)2] = ÷ (1+0)ē2 [\+w32]

Fxx (E) = F (Sxx (w)]

= F [RI(E)

Sxx (w)

F[eale] =

20

022+02

mean square value = Rxx (0)

(or)

Average Power

1) The power spectrum of

a

process (E)

sca)

=

(1+63) 2

0

Find the auto-~

average power of the process.

is given by

correlation the and

soln :-

given

S(W)=

a+w22

Rxx (z)

་་

F[Sxx (w)]

= [(tage]

て

Rxx (z) == (HZ)ē?

4

Average Power

C=0

= Rx+(0)

Rxx (0) = + (+o) e

4

formuls

(--F2 [T/632] ===(HE)

=

1/4

4

2

Find the average

power of

the process

Sxx (W)

4+w2

Soln:-

given Sxx (W)

=

4+w2

To find Pxx (e)

Rxx(e)

==

F

4+w2

に

a2 that

8+w

W

+[a] = 2 a

-2121

e

Rxx (z) = = =2121

4

The average power

<= 0 =>

A3) Find the

Rxx(0)

mean

w29

=

4

Rxx (0)

年

-2(0)

=

Square value of the process

8xx(w) =

w4+5W2+4

Soln :-

+9

given

Sxx

(w) =

045044

w2+9

Sxx(ou) =

(w2344) (w371)

Put WEU

ата

A

B

Sxx(es) =

+

((6+4) ((+1)

u+4

471

multiply (u+4) (4+1) on both sides

4+9 = A(uti)+B (4+4)

Put

a=-1

~1+9 = A(0) + B(+4)

SB=8

B=8/3

-4+9 = ^(-4-H1) + B(−4+4)

То

Ba

a=-5/3

4

A==-=-=-=-= & B=

8

value in ean@

3

w2+4

S(w) =

=

돟

(w2+4) (w2 71)

-573

W874

() + (+2

3

+

8/2 W2+1

1+w2

Rxx(z)

=

=

=(2tu)+8 (1)

W⋅KT

= [ a2 + w = ]

a2+w2

20

21

alel

12+w2

رح

R x x G ) = = =

= = = = 2 + 1 ] + = [ = = = = 3]

3

Square Value

The mean

Rxx (0) =

3

3

Rxx

(0)

[+ Ce°)]+용 [1⁄2 (88))

3

2

x4+2= 틈 +용

12

3

Rxx() =

-5+16

12

3×2

11/12

of the process Ex(t)} •If its

S(c) =

Find the average of the

psed is given by, low2 +35

(w2+4)(@2+9)

Soln:

given

S(W)

low2+35 (w2+4) (w2+9)

Rxx (z) == "[s(w)]

S(W) =

2

10w2+45

(es2+4) (3+9)

Put w2=u

lou +35

A

B

+

4+4

(4+4)(449)

multiply (u+4) (4+q) on

4+9

both sides,

10u+35 = A(U+q) + B (4+4)

---

-90+35 = A (0) +B (−9+4)

4=-9

-5B = -55

a=~4 = -40+35

=

5A=-5

B=11

A (-4+9) + B(0)

A = -1

Á, B Value in eqn

2

S(W) =

10w2 +45

(w2+4) (w2+9)

Rxx(t) = F [S(W)] ==

WKT

=

ニキ

29

е

[+] +

alel

we get

+

es2+4

W2+9

+11

42+32

司

Rexx (z)

2121

(z) =

੨੭॥੮॥

+11

2(2)

2(3)

Rxx

-312)

4

+

6

The mean Square Value=Rxx fo)

Rxx (0) === (1) + 11 (1)

Rx(0) =

ХХ

4

4

Hall

=

4

6

-3+22

12

SM

Find the innan Shuere*,* you are

given

the

PSD

XX

Sx (w)

157+1242 (16+B)(9+62)

Find the

average

Power

Soln:-

given S

(w)

157+1242

(16+w2)(9+43

let

w2=u

5*(*4) =

157+24

A

B

=

+

(16+4) (9+4)

16 tu

multiply (16+4) (9+u) on both sides we get,

яни

157+12 as

=

A(U+q) + B (4+16)

Putl=-4

157+12(-9)

=

ACO) +B(-9 +66)

TB = 157-108 = 49

7B=49

Put

9=-16=>

B=7

157+12(-16) = A (~16 +9) +18 *(*0)

157-192 = −7A

77A=+35

A=5, B=7 in egn

egnR

((w)

=

+

16+42

7 9+w2

- A='35 = 5

=

Rxx(x= EX [sca)]

=

WikiT È' [a2+W2==

Rxx (E) =

20

5

+

42762

しょ

Rapel

-312)

+7

6

The average power

=

RxxCo)

Rxx (0) = 5 (1) + % (D)

w2+2

8 (w) = w2 + 13 w2=+36

To film! Rx (0)=2

Rxx(0) = $400 24/15/1

12/

15+2

24

=

43

Cross

power Gedral density i

Properties:

BXY (W) = √ Rxy (D) GTWEAT

e

dr

-iwz

Syx (4)

√ Ryx

(c) e

dc.

க

ух

The averge power is

I

211

Pxy = Pyx= ±

2π

Properties :-

Sxx

jus

**له**

xy (w) dw

sxyc

S Syx (w) dw

(て)

(W)

ху

Real part of Sxy (w) is an even fn. of w imaginary part of Sxy (W) is an odd fr ofw,

< 12

2)

3)

A

Sxy (w)=0

5)

If X(E) &Y(t) are uncorrelated

Exy (w)

=

if

x(t) is orthogonal,

E[X]OE [Y] [(w)

.

The cross

power Spectrum of a

real random

Process x(t) and

Sxy (41)

=

0

y(t)

a+jbw/w) <1

Jotherwise

**is** given by

San*:*

given Sxy (w)

Satibw

ン

; otherwise

Rxy (7)

8

5(w)

ху

jast

gave dres

=2π {{a+jbw) e das

211

21

to

サ

[

#

(adw dw + jb Swdw]

-

1

des+gb";

a [Corwe+j sinwe) des+jb [ w (coswe + sinwe) do

even

*odd*

eron

- 21 [2a√ coswedes to + 1b 2 [ufruedas to]

शा

217

2b

[2a (sinwe) \_ 2:6 [w[-co

て

ट

Odd,

2

(J2=-1)

Sin

[-00

+ [29/Anz\_0)\_26 [-COSE + SINE -0-0]]

휴

2

2

Casinz

1

+ base - brine]

て

て

==== [(az-b) sine + becost]

Frez

If x(t) and y(t)

Processes

are uncorrelated random

•]]

then Find the

ACF

of z

if

x=x(t)+y (t)

·

using this

ACF find

find sz

(W)

ZZ

Solbi given

== x(t) +*Y*(t)

If x(t) &y (t) are uncorrelated random Processes,

&y(t)

Cxy(t & t+c)=0

E[xit)], E· [y (t)]

Rxy (t) =

Ryx(t) = Rxy

(t)

2

given

Z(E) = x(t) + y(t)

WIKT B22(t) =E[ 2(t)=2(++2)]

=E

== {(x(t)+y (t)) = (xCE+O+YCE+ED)}

=

=E[x()• X (E+c) +x(t)•Y(€+c) + Y(E)=x (E+2)+Y(E) Y(t+c)] E[x(t)•x(+c)]+E[x (£) • Y(++) +E[Y(+) x({+}]+E[Y().

= Rxx (E) + Rxy (2) + Ryx (e)+ Ryy (c)

== R xx (c) +2Rxy (t) + Ry (c)

3

(by )

The power spectrado density of (z (t)) is

#[Rx+(E)+2RxyCZ)+RY(Z)]

Sz2 (w)

=

{12 (w) = sxx

S (w).

w) + 23 x (w) + Syy

+28

ху

Y(t+c)

linear Systems with Randoro inpeets

Properties**:**-

1) If

a

system is such

that its input x(t)

and its output y(t) are related by

Convoluation

integral

then the sytem is

a

linear time

Chvariant system.

له

If

Sb (t) at co

bit) is absolutely integrable the system is said to

be stable:

رضاء

A system is stable if for every bounded input, the system. given bounded output.

The power spectral densities

of the Empat

Processes

relation

where

in the system

Syy (w)

=

H(W) is the

impulse response

Formula:.

are

connected by the

| H(w) 12 Sx (w)

للاار

XX

Fourier transform of unit

\*\*(\*) on

F[Rxx(e)]

12

Sxx(c)

2)

:[=arry] =

*-29*

a2tu2

3)

F[ebt uct)]

}

b+iw

47

H(W) = F[h(t)]

& Ryy (z) =F'[Sxy (w)]

Formula!

If

x(t) is the impact & Y (f) is the but put

and b(t)

å

|

the transfer fandion then

Syy (w) = | Hrw) | 2 sxx (w)

*A*

WSS process

x(t) & the input to

a

linear sytem with "cropulse response h(t)=2ēta If the alto correlation

fm. of x(t) & R1(C)==410

Find the power spectral density

process y(t).

Can:- given x(t) - input process

of the Dutput

(ESS)

outpeat process (ass)

усе)

giren

We know that formula,

[xx(t)

(e) =ĕ41=1

Syy (c) = 1 # (C) I2 Sxx (a)

°F[Rxx (C)]

Sxx

(CJ)

===

=[= 4121]

S (w) = 2(4)

42+w2

H() = F [b(€)]

b(t)=2ĕtt

;>0

&b

い

юкт

(WET DRIEY] = 20)

&

16+02

#[b(+)] = F[2=\*\*]

H(w) = 2

7+i∞

[HRW)) =

THE WOR

2

√49+w2

=

4 49+02

3

subsitituting

(10) eng

& in can D

Syy (W) = (24+WP) (Toter)

Syy (Co)

49+w?

32

G9+w2)(16+w?)

Consider

the linear system

x(t)

9(4)

T

6+ja

XIE) is the input & y(t) is the output of the ystem, the outo correlation of rect is Rx (O)=38(4) autocorrelation fr. & the mean square

Find

PSD

Value

of the output.

Soln:

given

XX

R (z) =

=

35(+), Ace

=

6+jw

To find

Formula

find Syy (@Ryy (t) & REO)

Syy (w) = |H(w) 12 x (∞)

уу

$xx (w)

(c) =

F[RX+(=)] = F [35(+)]

HEW) =

6+j w

... [HOWS/2

=

361252

| Haw)|==

Byy (w)

ဖာ

=

едь

√36+w2

Syy (c) =

I'Hey 12 Sxx

Sxx (c)

(36+62) (3)

3

36+62

・('F [54]=1]

2

Ryy

ты

(z) = F

[Syy (a)]

чу

Ղ

[367

Ryy(0) = 3 ⋅ 12

mean Square

36+62

问

-612)

44

value of output

Ry() == C1 = 1/4.

2G

a2 w2 ] = [alel

**2**

a2+w2

25

61c1

= [[4(4)] = Ryy (0)

6171

Sxxy

(w)=

3

364c7

; Ryy (c) =+1

3 A WSS Process

(0)

xco with Rxyco) = Realt

'À' and 'a' are real positive Constants to the input of an LTI Systems

abt uct)

where 'b' is real positive

where

is

applied

with

b (t) =

constant

• Find

Soln:-

the PSD of the input of the system**.**

given Pxx (c)=129lcı &bc=e ou(t)

To find

formala

ht

Syy (w) = ?

Sxy (w) = 1 H (w) 12 Sxx (CD)

4

F[Rxx(E)] =F[aĕarzıy

abt

Sxx (a)

Sxx (W) = A

да

(d2w2

b() =

F[h(t)] = F[eb tu(t)]

bcw)=

b+jw

1bcws/2

1

2

(ACO) = Sheviciut

-iwt

\_bt\_iest

dt

8 = (b+iw) t

*3*

वस्

dt

6237w2

Subsi tutatoy 3 in est @

Syy (a)

=

2Aa

DAGZ) (B+W) //

H/W) = b+iw

b+iw)

A Circuit

bct) =

bas

an impulse response given by

+ ; ost≤T

otherwisto

Syy (w) interms of Sxx(W).

Evaluate

Soln &

The transfor

function

H(W) =

jabet

√ bet) e de

-iest

=

5+

-iwr

de

T

+[

-iw

Съсят

-

T

XX

H(w) is given by

]

-1

CosWT-isinwT)-1]

ётся

L(I-COSENT) tisinwt)

*(* + ==2)

ётся

H (w) = 1 sinnt (I-coscut)]

τω

:. | H(w)/2

1

=

(-2 = -+(-1)=1)

(: (a+b)2

TREE [STAWUTH (1-COS cor) ) ( (a to 12 = a+b2)

ग

[ sin cut + cos2 WT+1-2COSCUT}

== WT

taz [2-2008WT]

=

(I-COSCT)

7222

(:(1-coso)=2sine

| Hrew*)2* = 2 (2 sin2 OUT)

Syy(w) = | Hew))2 & Puz

Sxy (w)

=

Sx

(sin (WI)"

2

·Sin2 (WI)

*2*

sin(1)

(WI)

Sxx(xx)