Lacture 5 Page Page Student Notebook

| * | Exponential Imput |
|--|---|
| = | Let us choose as elementiery impet $u(t) = e^{st}$, where SEC is a Complex number. |
| | |
| | If s is neal, then u is a simple exponential |
| = / | If S=jw is imaginary, than the elementary input most be accompanied by the "conjugate |
| | u(t) + u(t) = ejwt + e-jwt = 2(0)(wt) |
| | Lots sis imaginary, then &((t) = est must |
| N/A | De understood es a "houlf" of a sinusuidal signal. |
| ************************************** | If S= @+JW than 3 |
| 9 | U(t) + U*(t) = 2et (o) (wt) |
| | () () () () () () () () () () |

L> Ampet u is a half of a simusoid with exponentially-changing amplitudes

=> For unit stop input U(t)= St, SA S=0.

So U(t) = 1 + t>0



| 1 | |
|---------------|---|
| | |
| 4 | Output orespons a to elementary imputs |
| | |
| 3.4 | y(t)= ceAt ×(0)+c [A(t-r) Bu(r)dr + Du(t) |
| 7 | G(E)- CC SC/C C BULLIAN DORY |
| | 0 1 1111 55 |
| => | Plug in u(t) = est |
| | $y(t) = 11 + C \left[e^{A(t-T)} \right] e^{sA} d\tau + Dest$ |
| -> | G(E) = 11 + C P OF A DE |
| - 1 | 19-12-1 = 12-1 - 0 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - |
| (4) | 39(2)3 E |
| | |
| - | C et en se dr |
| 1 | CULLY CONSTRUCTION CONTRACTOR OF THE |
| | |
| | $\frac{\nu}{\sqrt{(t-c)^{\gamma}}}$ |
| | CeAt (SI-A)7 dr B |
| | |
| ندا | with the seas to white the in |
| | (wit-2) ionale labitation ori |
| \Rightarrow | If (SIA) is inventible (i.e., Sis not an eigenvolve |
| () | dA), hom |
| | A A A A A A A A A A A A A A A A A A A |
| | y(t) = CeAt X(v) + CeAt (SI-A)-1 exI-A)t - IB |
| | |
| | The pest will |
| | |
| | TIME CONTRACTOR ANTOSET |
| | (y(t) = (CeAt[x(0)-(SI-A)'B]+(C(SI-A)'B+D]est) |
| - E | |
| | |

Steady-State Despumpe



The system is asymptotically stables
the transient response will converge to

=> The steady state susponse to an imput $U(t) = e^{st}$ can be written as:

ys, = G(s) est, G(s) = C(sI-A) B+D

1 (GCS) € C

> The function a: S > as) is knows as the transfer function,

* Engyency napons.

is a Sinusoidal signal (s=+jw)

U(t) = elut + e-jut = 2(0) (ut)

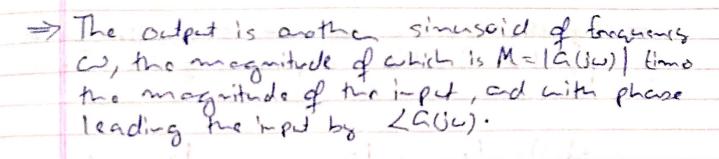
=> The output is in the

y(t) = a(Ja) elut + (a(-ju) e-jut

= Wed Gront West Gront

= 2M (0) (wt+0).





can fled the Soldier of to more complex i-put.

* From State-space to Transfer Function (SISU)

=> IP A is diagnod, with cigarvolos >, 2n-2n
His simply becomes:

ordived furthor of the form

* Form Toasferfrition to State Space (SISO)

State-space models (A,B,C,D) such that

S(S) = C(SI-A)^B + D:

=> Of the transfer function is written as a partid fraction expansion of the form

 $g(s) = \frac{P_1}{S-Z_1} + \frac{P_2}{S-Z_2} + \cdots + \frac{P_m}{S-Z_m} + d$

than a oradization is,

 $A = \begin{bmatrix} \lambda_1 \\ \lambda_2 \end{bmatrix}$ $A = \begin{bmatrix} \lambda_1 \\ \lambda_2 \end{bmatrix}$

C=[JP. JR - JPn] D=d

=> On the general case,

g(s) = bnn 5 + bnn 5 + - + bo +0

sh + ann 5 + - + 40

You can verify that the following is a minimal orchircheon of 9(5)

C= [bob, --- bnn] Dc [d]



* The Laplace Transfur

Sum of Complex exponeticl8?

→ Yes! The fool for this is the Laplace trasformand the inverse Laplace transform.

 $f[u] = U(s) = \int_{0}^{\infty} u(t) e^{-st} dt$

=> The inverse explace transform is donoted

1-'[U] = 4

 $\frac{U(t) = \frac{1}{2\pi j} \lim_{\omega \to \infty} U(s) e^{st} ds}{6-j\omega}$

=> So custing the church corporation we can
comet any entitions imput u(t) as an
(infinite) sum of complex exponentials.

=> le une con mite output es:

4(t) = 1 1/m (g(s) U(s) est ds

6-70

Page y(t) = 1-1[g(s)V(s)](t) 2 [8(4)= g(s)V(s) Y(s) = 9(s) US)

Date