ARYAN RITWAJEET JHA | EE 523 A05
~~SP~~ SPRING 2023

1. Classical model ~~of~~ for the Kundur 11 bus system utilizes the same reduced Ybus matrix

: Ygen for the power flow equations.

(Refer to ~~HW~~ A04 for its computation).

$$\underset{3\times 1}{\dot{\theta}_i} = (\omega_i - 1)\,\omega_s \qquad i = 2 \text{ to } N_{pv}+1$$

$$\underset{3\times 1}{\dot{\omega}_i} = \frac{1}{2H_i}\left[P_{m_i} - \sum_{K=1}^{N_{pv}+1} Y_{gen_{iK}}\, E'_K \cdot E'_i \cos(\gamma_{iK} + \theta_K - \theta_i) - K_{D_i}(\omega_i - 1) \right]$$

$$i = 2 \text{ to } N_{pv}+1$$

Assumptions: Angle dynamics are much faster than Voltage dynamics.

- ~~E~~ Machine internal voltages $\sqrt{E_{q_i}'^2 + E_{d_i}'^2} = E_i'$ are ~~con~~ assumed constant. They are obtained either by initialization or simply given in the system

$E'_{q_i}, E'_{d_i} \Leftarrow$ assumed slow variables.

$\Downarrow$

$E'_{q_i} \to c$

$E'_{d_i} \to c$

$\therefore E' \to c$

- $E'_{q_i} >> E'_{d_i} \Rightarrow \gamma \approx \frac{\pi}{2}$

and ~~$E' \angle(\theta - \frac{\pi}{2}) =$~~ E

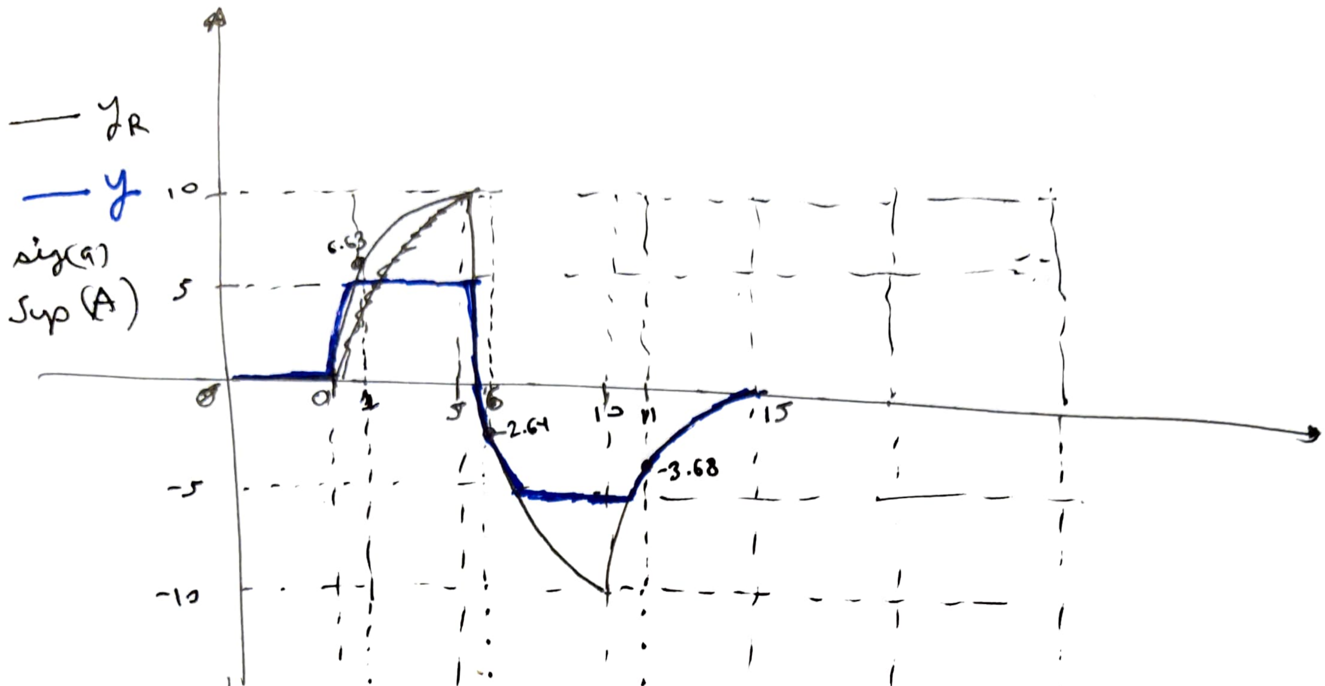
$\because (E_{d_i} + jE_{q_i})\angle(\theta_i - \frac{\pi}{2}) = E_i' \angle \gamma_i$

& $E_i' \angle \frac{\pi}{2} \angle \theta_i - \frac{\pi}{2} = E_i' \angle \gamma_i$

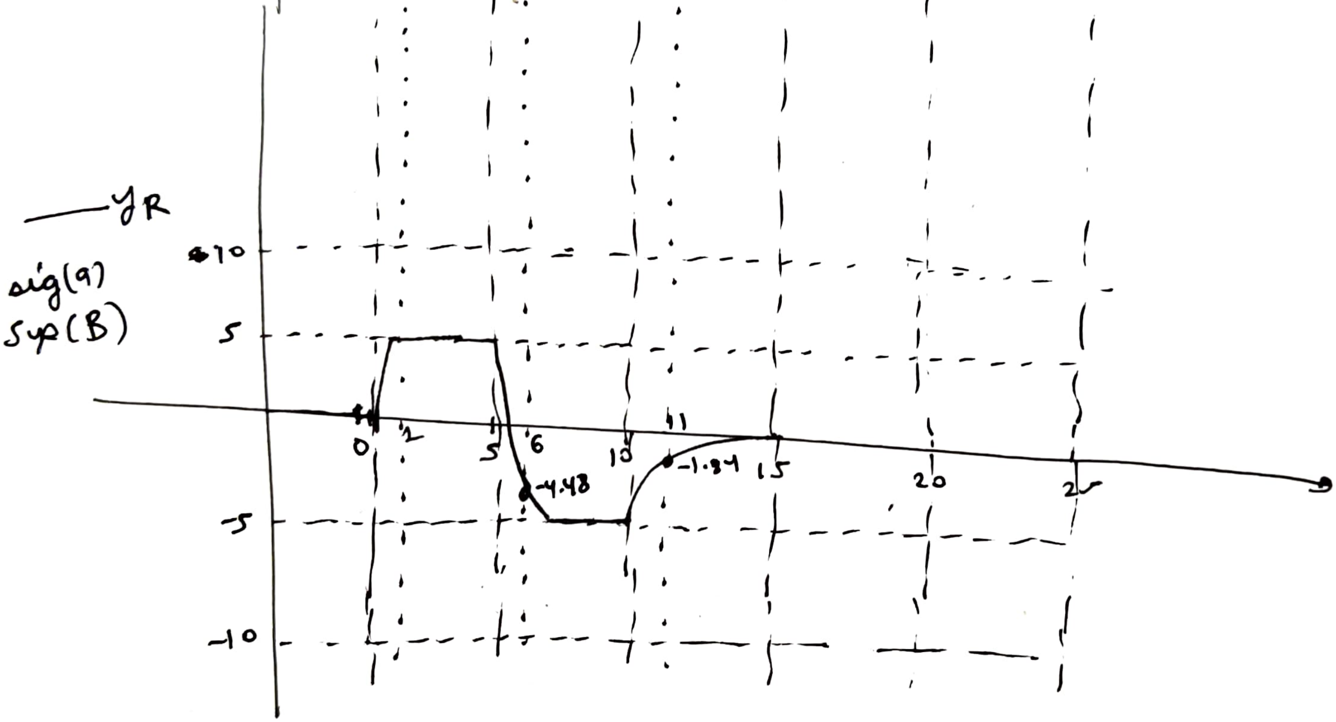
$\Rightarrow \theta_i \simeq \gamma_i$.

So ~~we~~ can use θ_i instead of γ_i ~~is~~ as ~~we did~~ was the case in Type 2.

2.)

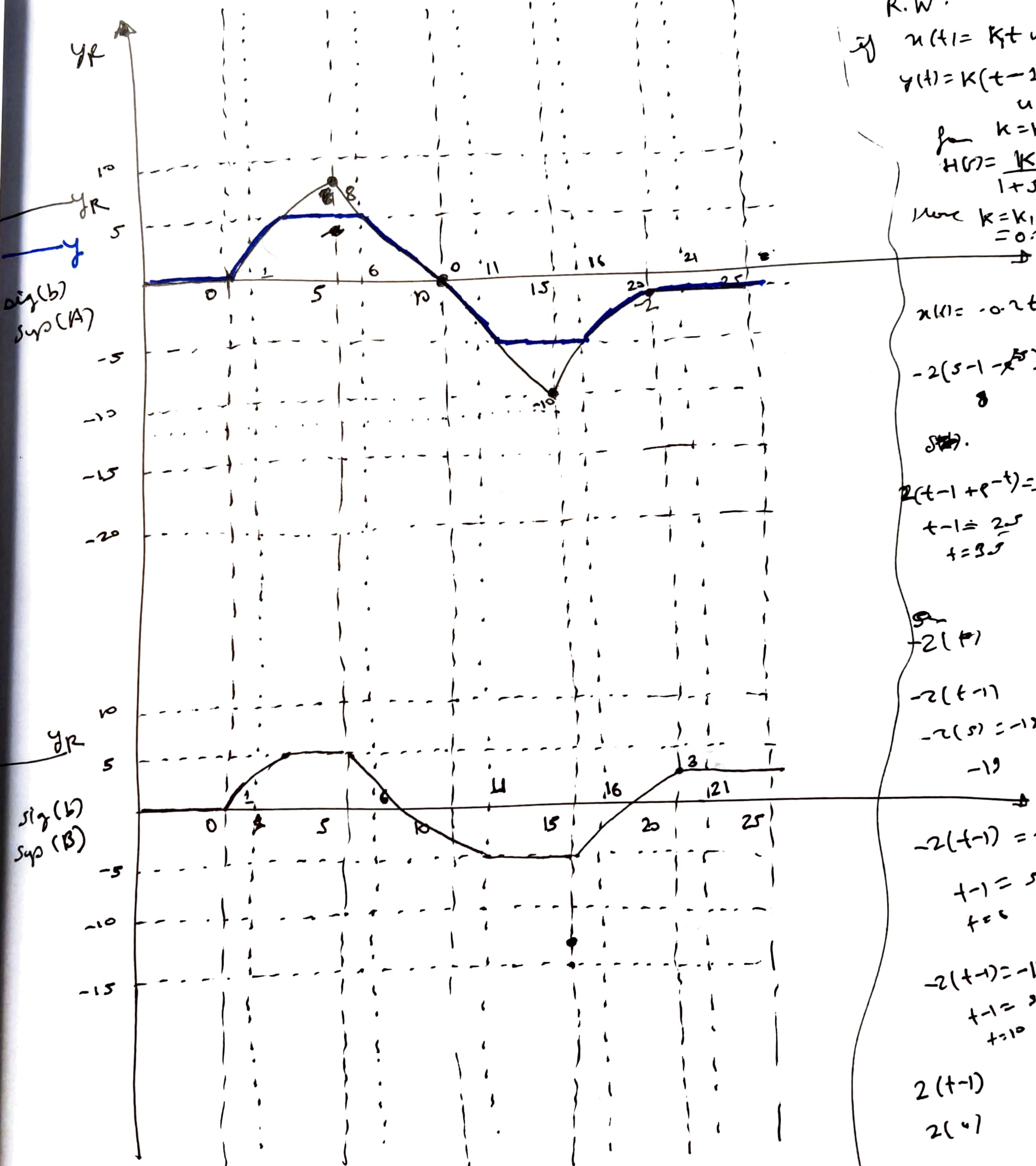


y_R
y
sig(a)
Sup (A)
10
5
-5
-10
6.63
-2.64
-3.68
0
1
5
6
10
11
15



y_R
sig(a)
Sup(B)
10
5
-5
-10
0
1
5
6
10
11
15
20
25
-4.48
-1.84

$\boxed{2.2}$



R.W.

if $x(t) = Kt\,u(t)$

$y(t) = K(t-1+e^{-t})\,u(t)$

for $K = K_1 K_2$

$H(s) = \frac{K_2}{1+s}$

Here $K = K_1 K_2$
$= 0.2 \times 10$
$= 2$

$x(t) = -0.2t$

$-2(5-1-e^{-5})$

8

$2(t-1+e^{-t}) = 5$

$t-1 \doteq 2.5$

$t = 3.5$

$-2(t)$

$-2(t-1)$

$-2(5) = -10$

-10

$-2(t-1) = -10$

$t-1 = 5$

$t = 6$

$-2(t-1) = -18$

$t-1 = 9$

$t = 10$

$2(t-1)$

$2(4)$