

JYSçãÑÑ s ys-VÑÓ yÓ ÓÑÑ SéÑÑ Óyüä½ ä ú

- .ú ' » E 4 ' ! ® N , +± Ý , 7 E/ Á Ô c æ'

• È w9^ \ \ wF ' *

%-D GT " 1è- c) ; Ô c-A/£ m"K,>->-¶ œ®!®o

...œ@Áµ & - 1"L<3ì T2(4 wý ' - .ú Ý , +±7 E/ Á Ô c æ' NÑuEÖð±EM 2(4 +±E 4 ' ! ® N ,
w- Ä' ! ® N , ; Ì L<3ì T2(4 x 60v u+±DÀ' çDÀ' ' ! T w €DÀ' ,%9 # w 52+±DÀ' 1 • ,%
9 m w ® N , , Ì 2(4 %og=ØÔ &AŽE =yDÀ' ú NµÔ c 2(4 @@Î ^ ^ » Ì L<3ì T2(4
x 6 W- ï • 1 : -> Ç T W ® N , +±! ® ï • \ W +± # +± &c ; 3E 4 ' ! ® N , ; Ö . L •
Ô c - \ ,%4 5 w = - .úQ®7 E/ Á Ô c æ' A æ' 1 • : ÊBfÌ 2(4 N , wò V*U£DÀ' œ
E =yú NµÔ c w L-@@Î ï "x • & Ì 2(4 +±² F 'ä . W- ï • 1 : -> Ç TE =y>ï "x - ; Fö*U ÄfUK
qüç:ù)3 @@î; ³ K (Ü2(4 +± Ç T w ,L4 ÉO'@î³ æ' +±6 u T

œl| œ@Ä 4 ' ! ® N , L<3ì T2(4 7 E/ Á Ô c Ö . L • Ô c Q® T K (Ü2(4 Ô c • { Ç
> A' X * •
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° Kë M±x " : V » Ô c • @@Î%

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Ô c • +±@@Î¹ È(Ý +e,%&P Kc2(4 +±KzKö- C
N , " ! ® N , : ...U œO ^ K MÄ'59\ 3P Kc
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* ^ »! ® N , ; ÊKr=ØÔ &AŽx 60v u+±DÀ'
çDÀ' ' ! T " ' ! ® N , , ÊKr=ØÔ &AŽ
E =yDÀ' ú NµÔ c 2(4 @@Î%, z e>î+±! ® N ,
• < g.è • +±¹ Kc 3 æ8 "V*U2(4 +±DÀ' ðÄ'

¹ 2(4 DÖ@œœ' & 3 æ8 Z+±2(• E =y] @Î% ^
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* ^ »! ® N , +±KcN { & ® ï FÜ > " ! ® ï FÜ
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lµ &3ì T # 2(4 +±7 E/ Á Ô c æ' -A/£ 3ü
= g ³ @äGM³ FÜ+±A/£ & %æ% L V*U-> Ç T0v
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ú "- ï • \ # +±" Ô c T6* µ Këf ± %ú \$A
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mf ± "s \ " - É 3 £ ^ 3ì T Ç e 2(4 ,! Ò Ö -]
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ï • +± C(= • ! %U ú \$A' ' -m7 "EÖðB'
- Kc{ E\$ " • 59 ý ' ³ Ö . L • Ô c "£ - " Á*U
» 3ì T2(4 &çì T2(4 &¼g 2(4 0vM³ ®k°%µ
&3ì T # 2(4 " " ([ß! Öý ' - .ú x 6 Q® T +±

7 E/ Á Ö . L • Ô c æ" " - U i • # + ± Ž #
8 œ* . 7œ± ±C CVT6* %

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4 @ @ Í : ° Ê B f = Ø Ô & A Ž ± ± : o Ö È " N , " ò V
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Öt K MÄ E

N = y • ± ± , . Ö È " æ / 8 - 7 Y \ ✎ 6 - 8 • <
± ± , 1 L < 3 i T 2 (4 á

$$\begin{cases} x_B = f_B \cdot x_0 \\ x_0 = f_0 \cdot x_0 + g \cdot x_0 \alpha + \mu \quad \% \text{Bo} \\ y = x_B \end{cases}$$

< Z " u â t 1 y â t \ 2 (4 D À ' 1 D À ' x_B â t 1
x_0 â t^{-B} \ 2 (4 ' ä . F ü f_B â t ' f_0 â t^{-B} 1 g â
t^{-B} \ W ± ± v # p Û * • + µ â t^{-B} = • g 2 (4 W
- ± ± : -> Ç M i %

t @ @ Ö e L < 3 i T 2 (4 % Bo 6 A ò 6 \ - ± ± = Ž
% œ ï ì % æ £ A ... U W e • M_B " M_0 " M " M_x 1 M
\$ B à 8 E : 0 v <

$$\left| \frac{N_B}{N} \right| j M_B \left\| \frac{N_B}{N_0} \right\| j M_0 \left| w \right| = \left| \frac{N_B}{N_0} \right| \mu \left| j M \right|$$

$$\left| b \cdot x_0 \right| = \left| \frac{N_B}{N_0} g \cdot x_0 \right| j M_x$$

$$\left| d \cdot x_0 \right| = \left| \frac{N_B}{N_0} f_0 \cdot x_0 \right| j M$$

œ æ t @ @ # ± b % Bo x_0 o ± ± T < W " s O S \$ \ -
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= / Ø ± ± " C " : 0 v < \ d % Bo x_0 o \ j M C E G 3 ü e '
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4 D À ' c ^] = Ž % œ ï % æ K p p (< < ± ± È 2 " 9 #
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/ £ 2 (4 2 F ' ä . F ü x_0 1 : -> Ç M i µ W ± ± ò â 8
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T ± ± Ô c , % s \ " - U L < 3 i T 2 (4 % Bo Z ± ± v
p Û * • f_B " f_0 " g C E W ± ± ò â 8 " 7 E Ô c æ'
± ± Ô c T 6 * 3 k 9 , 8 K z * G 7) 7 ! K (Ü 2 (4 ^ / %

µ & 7 E K M Ä " Z y ' - . ú ' » E 4 ' ! ® N
, ± ± Y , 7 E / Á Ô c æ" " U 2 F ' ä . F ü x_0 "
v # p Û * • f_B " f_0 " g 1 : -> Ç M i µ t W ± ± ò â
8 " 6 * - 2 (4 D À ' c ^] = Ž % œ ï % æ K p p (<
< ± ± È 2 " œ * @ K (Ü 2 (4 ± ± Ç T %
Ž Ö E 4 ' ! ® N ,

50; ~] L < 3 i T 2 (4 % Bo ± ± 2 F ' ä . F ü x_0 " v # p
Û * • f_B " f_0 " g 1 : -> Ç M i µ t W " g 3 i » Ô
c • @ @ Í " Z ± E M P - . ú Y , ± ± 1 K c E 4 ' ! ® N
, % 1 K c E 4 ' ! ® N , ± 6 - 8 ' ! % æ ± ' ! ® N ,
\ 1 K c 3 i T # 2 (4 " A # ' ! ® i • \ W ± ± æ
' ! ® N , ; L < 3 i T 2 (4 % Bo ± 6 0 v u ± ± D À ' - D À '
' ! T " , ì 2 (4 E = y D À ' ú N µ Ô c • @ @ Í t e
' ! ® N , • < 0 - , " ò V * U 2 (4 D À ' 1 = D À '
ú N µ Ô c 2 (4 @ @ Í " Ô c • 4 ± 0 - , & / 8 @ È (Y %

U Ô c 2 (4 @ @ Í D ö 8 Z " E 4 ' ! ® N , 3 ,
ì L < 3 i T 2 (4 " ' 3 ì Y : o ± ± L < 3 i T Ô c K M Ä
D T C g ! Í 0 - , ± ± ± 6 W # i • ± ± 1 K c # 3 i
T 2 (4 Ô c K M Ä %

Ç 3 Ö e , 1 L < 3 i T 2 (4 % Bo ± ± D À ' q D À ' !
T ; 8 E 1 K c 3 i T # Û 3 æ / 8 0 v \$
j % Bo + a_B % Bo % Bo + a_1 % Bo % Bo = b_1 % Bo + d % Bo
% Bo

< Z " a_B = - \frac{N_B}{N} - \zeta v_B \cdot w \&_1 = - \zeta v_0 \cdot w \&_1
= b 1 d = v^{m+B} \cdot w \&_1 \ W ± ± # ' ! ® i • " s b_1
± ± O S \$ \ - ± ± A . : %

@ Í ; œ ^ \ » x_B = f_B \cdot x_0 " E = y 1 o) Ä
x_B = \frac{N_B}{N} x_B + d \cdot x_0 + \frac{N_B}{N_0} \Delta + b \cdot x_0 \alpha \cdot %
œ æ @ @ \ \$ B à : 0 v < \delta > B ± ± (< e • " £ Ç v

$$v_B = \frac{x_B}{x_B^0 + x_B^0 + \delta} \cdot \text{œ} = \frac{x_B}{x_B^0 + x_B^0 + \delta}$$

$$v = \frac{\delta}{x_B^0 + x_B^0 + \delta} \cdot \text{œ} = \sum_{i=1}^m R v^i = \frac{\beta - v^{m+B}}{\beta - v} \cdot \% \text{Bo}$$

< Z " m \ • j • " v_B " v_0 " v 1 \zeta t g 6 * y ± ± A \$ B à

| v_B | < β" | v₀ | < β" | v | j β¹ | ζ | < m + β%
Ç v f_s \ , 4VM1 * • "£=•Dë< g

$$f_s = \zeta v_{\beta^i \beta} + \zeta v_{\sigma^i \beta} + v^{m+\beta} \quad \%0$$

f > %0 < 1 %0 < - ", 4VM1 * • □ 6 f_s β
+±! T "0- , +±Ö) Dð8 - 8

$$f_s = \frac{\beta - v^{m+\beta}}{\beta - v} v_{\beta^i \beta} + \frac{\beta - v^{m+\beta}}{\beta - v} v_{\sigma^i \beta} + v^{m+\beta} =$$

$$\alpha_{\beta} - v^{m+\beta} \frac{1}{4} \frac{x_{\beta}^0 + x_{\beta}^0 + \delta}{x_{\beta}^0 + x_{\beta}^0 + \delta} \frac{1}{4} \frac{x_{\beta}^0}{x_{\beta}^0 + x_{\beta}^0 + \delta} +$$

$$\alpha_{\beta} - v^{m+\beta} \frac{1}{4} \frac{x_{\beta}^0 + x_{\beta}^0 + \delta}{x_{\beta}^0 + x_{\beta}^0 + \delta} \frac{1}{4} \frac{x_{\beta}^0}{x_{\beta}^0 + x_{\beta}^0 + \delta} + v^{m+\beta} =$$

$$\alpha_{\beta} \frac{\beta - v^{m+\beta}}{x_{\beta}^0 + x_{\beta}^0} + \frac{\beta - v^{m+\beta}}{x_{\beta}^0 + x_{\beta}^0} \alpha_{\beta} + v^{m+\beta} = \beta \quad \%0$$

æœ 5 %0 < 1 %0 < " 3 %0 < f Æg

$$\dot{x}_{\beta} = \frac{M_{\beta}}{N_{\beta}} \dot{x}_{\beta} + f_s \frac{1}{4} \%0 + w \circ + bu =$$

$$\alpha \frac{M_{\beta}}{N_{\beta}} \dot{x}_{\beta} + \%0 v_{\beta^i \beta} + \zeta v_{\sigma^i \beta} + v^{m+\beta} \frac{1}{4} \%0 + w \circ + bu =$$

$$\alpha \left(\frac{M_{\beta}}{N_{\beta}} + \zeta v_{\beta^i \beta} + \zeta v_{\sigma^i \beta} \right) \dot{x}_{\beta} + \zeta v_{\sigma^i \beta} + w \alpha_{\beta} +$$

$$\alpha bu + v^{m+\beta} \%0 + w \circ \quad \%0$$

æœ y = x_β "3 %0 < f Æg

$$y \%0 + a_{\beta} \%0 \%0 + a_1 \%0 \%0 = b_1 \%0 \%0 + d \%0 \quad \%0$$

< Z "a_β"a₁"b₁"d g" | ® N , ±# " | ® i • %

$$a_{\beta} \%0 = - \frac{M_{\beta}}{N_{\beta}} - \zeta v_{\beta^i \beta} + w \circ " b_1 \%0 = b$$

$$a_1 \%0 = - \zeta v_{\sigma^i \beta} + w \circ " d \%0 = v^{m+\beta} \%0 + w \circ \%0$$

æœ #œU Ç)3 β±@î; Dð8 Z "δ¹ m U -
Ç3Óœ0! ² (<E6 " , 4VM1 * • f_s : \ \ -

+±" L<3i T2(4 %0±E 4 " | ® N , %0 Z " | ®
ï • : \ \ - ±%û Ri < v 7 @ß Ç)3 βh>®%0

*U \ @î; ³ 1 KcE 4 " | ® N , ±...UT " " ^ » " | ®
ï • : □ 6 \ - T " ' œ " , u → Ç " | ® i •

+±L È i %
" úce ; M4 ±KzKc- C N , ,%d " ; a & d . (3i

T2(4 %0 ; £ " | ® N , %0 4 ± • < ...UD ° T
/ " s \ ¹ 52 □ 6 ¹ • 0v u ±DÀ' - DÀ' " | T %E

\ g " | ® N , 3 Ì 2(4 Z ±P KdMi & W- Mi ¹ :
→ ÇM : 0vE Çð , 4VM1 * • f_s K ½ X U " | ® i • Z "

59Î 6 O ^ (, æ% ^ » " | ® i • Z 2 X ³ ; Ì

L<3i T2(4 Z x₀ f_β f_σ g¹ μ, % ±W œ"
' " | ® i • - 7Y □ 6 T80! & # ±! %æ%
#Z ± 7 E / Á Ô c , @ @ Î

f > Ç)3 β - " 1 KcE 4 " | ® N , %0 ; ,
1 L<3i T2(4 %0 □ 6 ¹ • 0v u DÀ' çDÀ' " | T "
' V*UDÀ' çDÀ' 0v u ±E 4 " | ® N , %0 ,
Ì L<3i T2(4 N , %0 E =yDÀ' ú N μ Ô c ,
@ @ Î %

$$N \dot{A} u " 3 " | ® N , \%0 \text{ of } \dot{A} E = \dot{a} . / \S K ! \cdot < \left\{ \begin{array}{l} x \%0 = A \%0 \alpha \%0 + b \%0 \omega \%0 + d \%0 \%0 \\ y \%0 = x \%0 \beta \%0 \end{array} \right. \%0$$

< Z "u â t¹ y â t \ 2(4 ±DÀ' ¹ DÀ' - (4 'ã
. >Füg x Æ = x_β x_σ Ô â t⁰ + E A

$$A = \begin{bmatrix} ! & \beta \\ -a_1 \%0 & -a_{\beta} \%0 \end{bmatrix} "$$

$$b \%0 = \begin{bmatrix} ! \\ b_1 \%0 \end{bmatrix} " \text{ and } \%0 = \begin{bmatrix} ! \\ d \%0 \end{bmatrix}$$

< Z "a_β"a₁"b₁"d %0 \ W ±±# " | ®
ï • " s \ b₁ %0 ±±0S\$ \ - ± " ^ t @ë0¹ %0
< Ä "b₁ %0 > ! %

50; ~ " | ® i • □ 6 T80! & # ±! %æ'
ZF*U ± 6 g Qç T ±Ö . L • Ô c æ' E =y Ô c ,
@ @ Î %

$$i \text{ wq} \beta \text{ c} \zeta v \text{ OY } \beta \text{ WA } L \cdot g \quad S_{\beta} = y \quad \%0$$

5 • 5 %0 < " & 7 < ! o) Ä
æ ß = y = - c_β S_β + %0 - α_β 0 + α_β + c_β S_β Ô %0

< Z "c_β > ! g @ @ Î i • " α_β \ L - > @ @ Î ± ± ÷ Ô c
Fü " - Ä %0 < U u * " %0 - α_β 0 M ± ± ÷ â 8
/ Ç %

$$E6 ; \ddagger \quad \text{Ô c F} \dot{u} \alpha_{\beta} g \quad \alpha_{\beta} = -c_{\beta} S_{\beta} \quad \%0$$

æœ α_β 3üDð # K! e • g τ₀ ±± - Kc\$ " • " 8ä Ä
Y ± ± ä . F ü x_œ

$$\tau_{\sigma^i \omega} \dot{x}_{\omega} + x_{\omega} = \alpha_{\beta} \quad \%0$$

$$æœ i \text{ wq} 0 \text{ c} \zeta v \text{ OY } 0 \text{ WA } L \cdot g \quad S_0 = x_{\sigma^i}^3 - x_{\omega} = y - x_{\omega} \quad \%0$$

& 7 < ! o) Ä
S₀ = x₀ - x_œ = - a₁ %0 α_β - a_β %0 α_β +

$$\alpha_{\beta} \%0 \omega + d \%0 - x_{\omega} = -c_0 S_0 + b_1 \%0 u + \theta \omega \quad \%0$$

< Z "c₀ > ! g @ @ Î i • " A

$$\theta = \left[\frac{\beta}{b_1} - \frac{a_1}{b_1} - \frac{a_\beta}{b_1} \frac{d}{b_1} \right]$$

$$\omega = c_0 S_0 - x_\omega "y"y" \text{BÖ} \quad \% \text{BÖ}$$

< Z "θ \ *^ W +±! @ ï • m ± = ± W ï • >
 Fü" @ @ 7 E/ Á , & £ E = y] @ ï %

@ Æ V ï • > Fü θ ± ±] @ Ä g

$$\theta = \theta - \hat{\theta} \quad \% \text{B} \text{ o}$$

< Z "θ̂ g W ï • > Fü θ ± ±] @ ï " A @ @ ± 7 E/
 Ä , g

$$\theta = \Gamma S \omega - \sigma \hat{\theta} \quad \% \text{B} \text{ o}$$

< Z "Γ g @ @ ï • A \ • Ç- Kb"σ > ! g @ @ ï
 ï • %

- ; "Ë Kr ± ± Ö c Fü E 6 g

$$u = - \hat{\theta} \omega \quad \% \text{!} \text{ o}$$

ææf > 7 E 7 E/ Á Ö c , ± ± Ö) D ð 8 - " ' Z

@ @ ± ± Ö c , %! o 1 7 E/ Á , %B o ò V * U 3 2 (4

+ ± D Ä ' ÷ £) • æ" L - > i " x • & 2 (4 + ± 2 F ' ä

. 1 ÿ • E = y] @ ï % , %! ; M 4 + ± 7 E/ Á Ö c " ' "

Z @ @ ± ± ' » E 4 ' ! @ N , ± ± 7 E/ Á Ö c , • < 0 -

, " @ » / 8 Ë (Y %

ÿ ± / Ç T 3 ½

N Ä u " Ç v

$$y_B = x_\omega - \alpha_B \quad \% \text{B} \text{ o}$$

f > 7 < " 3 %B o < f Æ E g

$$\dot{S}_B = -c_B S_B + S_0 + y_B \quad \% \text{B} \text{ o}$$

ææ3 %! o < ' %B o < " Ä

$$\dot{S}_0 = -c_0 S_0 + b_1 \omega \quad \% \text{B} \text{ o}$$

ææ^ %B x o < 1 %B o < Ä

$$y_B = y_B \left(\frac{\alpha_B - x_\omega}{\tau_0} - \alpha_B \right) j - \frac{y_B^0}{\tau_0} + |y_B| \eta_B \quad \% \text{B} \text{ o}$$

< Z "η_B g E 4 * • "1" i » 3 i T Ç e 2 (4 " & »

3 i T # 2 (4 " 9 d ... U η_B - Ä η_B | α_B | %

Ç v Ä f U ü z • ü * •

$$V = \frac{\beta}{0} S_B^0 + S_0^0 + y_B^0 + b_1 \omega \quad \% \text{B} \text{ o}$$

ææÇ) 3 #æ^ E 4 ' ! @ N , %B! o & Ö c , %! o &

7 E/ Á , %B o 1 - K c \$ " • %B x o m ± = ± K (Ü 2 (

4 " - É t @ Æ ß 1 0 = / θ " & » (< 4 Ç ± ± • e •

R_B " 8

$$V \% \text{B} \text{ o} j R_B$$

F ... U c_B " c_0 " τ_0 " Γ 1 σ - Ä K (Ü 2 (4 \ - 7! 6 * y "

Æ E 6 5 E / ± ± @ @ ï • - 2 (4 D Ä ' y c ^]

$$= \frac{\beta}{0} \omega \quad \% \text{B} \text{ o}$$

@ ï ; æ 5 • / θ %B o < & %B o < & %B o < 1 %B x o

< " & %B " o < ! o) Ä

$$\dot{V} = S_B \dot{S}_B + S_0 \dot{S}_0 + \frac{\beta}{0} b_1 \omega \Gamma^{-\beta} \theta + b_1 \omega \Gamma^{-\beta} \theta + y_B \dot{y}_B =$$

$$c_B S_B + S_0 + y_B + S_0 c_0 S_0 + b_1 \omega +$$

$$c_B \frac{\beta}{0} b_1 \omega \Gamma^{-\beta} \theta + b_1 \omega \Gamma^{-\beta} \theta - b_1 \omega \Gamma^{-\beta} \theta + y_B \dot{y}_B =$$

$$c_B S_B^0 - c_0 S_0^0 + b_1 S_0 \omega - b_1 \omega \Gamma^{-\beta} \theta + \quad \% \text{B} \text{ o}$$

$$c_B S_B^0 + y_B + \frac{\beta}{0} b_1 \omega \Gamma^{-\beta} \theta + b_1 \omega \Gamma^{-\beta} \theta + y_B \dot{y}_B$$

3 %B o < ' %B o < " Ä

$$\dot{V} = -c_B S_B^0 - c_0 S_0^0 + \sigma b_1 \omega \Gamma^{-\beta} \theta + S_B \% \text{B} \text{ o} + y_B +$$

$$c_B \frac{\beta}{0} b_1 \omega \Gamma^{-\beta} \theta + b_1 \omega \Gamma^{-\beta} \theta + y_B \dot{y}_B$$

$$j - c_B S_B^0 - c_0 S_0^0 + \sigma b_1 \omega \Gamma^{-\beta} \theta + S_B \% \text{B} \text{ o} + y_B +$$

$$c_B \frac{\beta}{0} b_1 \omega \Gamma^{-\beta} \theta + b_1 \omega \Gamma^{-\beta} \theta + \left(-\frac{y_B^0}{\tau_0} + |y_B| \eta_B \right)$$

%B o

ææf > _ • ü j k : 0 v < " Ä

$$|y_B| \eta_B j \frac{y_B^0 \eta_B}{\tau_0} + \frac{\varepsilon}{0} \quad \% \text{B} \text{ o}$$

$$\omega \Gamma^{-\beta} j - \frac{\beta}{0} \omega \Gamma^{-\beta} \theta + \frac{\beta}{0} \omega \Gamma^{-\beta} \theta \quad \% \text{B} \text{ o}$$

< Z " ε g (< ± ± • e • % V * U 7 < " 3 %B o < "

f Æ E g

$$\dot{V} j - c_B S_B^0 - c_0 S_0^0 - \frac{\beta}{0} \sigma b_1 \omega \Gamma^{-\beta} \theta +$$

$$c_B \frac{\beta}{0} \sigma b_1 \omega \Gamma^{-\beta} \theta + S_B \% \text{B} \text{ o} + y_B + \frac{\beta}{0} b_1 \omega \Gamma^{-\beta} \theta +$$

$$c_B \omega \Gamma^{-\beta} \theta + \left(-\frac{\beta}{\tau_0} + \frac{\eta_B}{\tau_0} \right) y_B^0 + \frac{\varepsilon}{0} j$$

$$c_B S_B^0 - c_0 S_0^0 - \frac{\beta}{0} \sigma b_1 \omega \Gamma^{-\beta} \theta + S_B^0 + \frac{\beta}{0} S_0^0 +$$

$$c_B \frac{\beta}{0} y_B^0 + \frac{\beta}{0} \sigma b_1 \omega \Gamma^{-\beta} \theta + \frac{\beta}{0} b_1 \omega \Gamma^{-\beta} \theta +$$

$$c_B \omega \Gamma^{-\beta} \theta + \left(-\frac{\beta}{\tau_0} + \frac{\eta_B}{\tau_0} \right) y_B^0 + \frac{\varepsilon}{0} \quad \% \text{!} \text{ o}$$

$$\phi = \frac{\beta}{0} \sigma b_1 \omega \Gamma^{-\beta} \theta + \frac{\beta}{0} b_1 \omega \Gamma^{-\beta} \theta + b_1 \omega \Gamma^{-\beta} \theta + \frac{\varepsilon}{0}$$

%B o

F " %! o < 0- ÆEg

$$\dot{V} j - c_{\beta} S_{\beta}^0 - c_{\sigma} S_{\sigma}^0 - \frac{\beta}{0} \sigma b_i \Gamma^{-\beta} \sigma +$$

$$\alpha \left(-\frac{\beta}{\tau_0} + \frac{\eta_{\beta}}{0} \right) y_{\beta}^0 + \left(S_{\beta}^0 + \frac{\beta}{0} S_{\sigma}^0 + \frac{\beta}{0} y_{\beta}^0 \right) + \phi \dots$$

ææÇ v 2TK65

$$\Omega_{\beta} \hat{a} = x \%_{\beta} "S_0" y_{\beta} " \dots j R_{\beta} W \hat{a} t^{\circ} \%_o o$$

< Z " R_{\beta} \ \ \bullet \ e \ \bullet \ \% U2TK65 \Omega_{\beta}^2 " \%_o x o < Z \pm E 4 * \bullet \eta_{\beta}^1 \%_o \beta o < m \zeta v \pm * \bullet \phi \dots U - T i " @ \textcircled{E} - T i 3 X g M_{\eta}^1 M_{\phi} \%

E6

$$\begin{cases} c_{\beta} & \beta + \alpha_1 \\ c_0 & \frac{\beta}{0} + \alpha_1 \\ \frac{\beta}{\tau_0} & \frac{\beta}{0} + \frac{M_{\eta}^0}{0} + \alpha_1 \\ \sigma & \alpha_1 \end{cases} \%_o x o$$

< Z " \alpha_1 > ! \ \ @ \textcircled{E} \hat{i} \ \bullet \ \% 3 \%_o x o < \ \ \bullet \ \%_o o o < " \hat{A}

$$\dot{V} j - \alpha_1 V + M_{\phi} \%_o " o$$

ææ& » (< \pm e \bullet R_{\beta} \ V \%_o o " - \hat{E} \alpha_1 \\$ B \hat{a} 8 E : 0v <

$$\alpha_1 \frac{M_{\phi}}{R_{\beta}} \%_o o$$

F " \in V = R_{\beta} \# " \dot{V} j ! \% \ \bullet \ V Z 2 X \pm m 6 \ F \ddot{u} F * \ \ 6 * y \pm \%

* ^ \%_o " o < \hat{A}

$$! j V j \left(V \%_o o - \frac{M_{\phi}}{\alpha_1} \right) - \alpha_1 + \frac{M_{\phi}}{\alpha_1} \%_o \textcircled{B}$$

$$\frac{1}{\tau_0} | S_{\beta} \%_o o | j \ \frac{1}{\tau_0} | \sqrt{0 \%_o o} | = \sqrt{\frac{M_{\phi}}{\alpha_1}} \%_o o$$

r " E \textcircled{D} \hat{E} T i \bullet \alpha_1 \pm i " \ \ - 2(4 D \hat{A}' y c \hat{^}] = \check{Z} \%_o \alpha_1 \%_o \alpha_1 K \phi p (< < \pm e \hat{e}^2 \%

" \ \ \%_o \beta o < m \zeta v \pm * \bullet \phi ; @ \textcircled{E} \hat{i} \ \bullet \sigma , \% " G f \ M_{\phi} \pm i \% s \ \ " E \textcircled{D} \hat{E} 6 \ 5 E / \pm \pm \zeta - K b \Gamma " \ \ - M_{\phi} \pm i \ \ \bullet \ \%

ú ‡ \bullet i , , L ; 3 ½

, z T G \bullet \mu \& , 1 L < 3 i T 2(4 \pm 7 E / \hat{A} \hat{O} c \hat{a} e" L - > \textcircled{R} , u - = \textcircled{O} \hat{A} \check{Z} \pm N , " \hat{o} \& N , Z \pm

F 3 W \ \ddot{i} \bullet \& - \rightarrow \zeta T C C * y \ddot{Y} \bullet E = y] @ \hat{i} " \textcircled{E} : 6 * 1 \bullet 6 ^ . \hat{e} \hat{i} 2(4 N , " 59 A \hat{O} c \bullet \pm 4 \pm \bullet < ; = \textcircled{O} \hat{A} \check{Z} N , \hat{o} 4 , \% \%

g^3 \in (Y' Z' » E 4 ' ! @ N , \pm Y , 7 E / \hat{A} \hat{O} c \hat{a} e" \pm EB \cdot T " U \bullet i , , L Z " \mu \& Q . \acute{u} N , \bullet < k 9 , : 9 \pm = \textcircled{O} \hat{A} \check{Z} " F \hat{o} * U , \% 9 \pm \hat{O} c \bullet E = y \hat{O} c " O \textcircled{!} \hat{i}' Z \hat{O} c \hat{a} e" \pm T 6 * \% E d \ \ r 3 \in (Y \acute{Y} , 7 E / \hat{A} \hat{O} c \hat{a} e" 1 \bullet : \hat{E} B f = \textcircled{O} \hat{A} \check{Z} N , " \hat{o} V * U = \textcircled{O} \hat{A} \check{Z} \pm D \hat{A}' \div \textcircled{E}) \bullet \ \hat{E} (Y P 1 \hat{e} \hat{O} \hat{O} c \pm ! \% \hat{a} \%

= \textcircled{O} \hat{A} \check{Z} \beta g

$$\begin{cases} \dot{x}_{\beta} = x_0 \\ \dot{x}_0 = x_{\beta} + \textcircled{R}_0 + 0!x + u + w \%_o o \\ \dot{x} = - "x + \beta!x_{\beta} \\ y = x_{\beta} \end{cases} \%_o o$$

ææ= \textcircled{O} \hat{A} \check{Z} 0 g

$$\begin{cases} \dot{x}_{\beta} = "x_{\beta} + \%_{\beta} + x \dot{u} \bullet x_{\beta} \alpha_x \\ \dot{x}_0 = -x_0 + \frac{x x^0 = \dot{x}_{\beta}}{\beta + x_x^0} \\ \dot{x} = x_x + x_{\bullet} \\ \dot{x}_x = x - \alpha_0 - x_0^0 \dot{u} \bullet \%_{\beta} + x_x o + \\ \text{ææ} x_{\bullet} + \%_{\beta} + x_0^0 \alpha_1 + w \%_o o \\ \dot{x}_{\bullet} = -x_{\bullet} + x + x_0 \\ y = x \end{cases} \%_o ! o$$

< Z " w \%_o o = . g N , : - \rightarrow \zeta M ! C \ddot{Y} \bullet M ! \% U , , L D \hat{o} 8 Z " K' 3 = \textcircled{O} \hat{A} \check{Z} \beta 1 \ \textcircled{D} \hat{A}' \ \ 8 \hat{a}

\pm " \textcircled{E} \circ \pm \% N , \ \text{æ} \% 2 \ N , K c \bullet \& i \bullet \& * \bullet 1 2 F ' \hat{a} . 0v o t \ \ W - \pm " 3 X E 6 \ w \%_o o = ! " \beta ! = \check{z} \%_o + \beta o " \textcircled{E} 3 \frac{1}{2} \hat{O} c u \hat{E} \% ' C " 3 ' Z ' » E 4 ' ! @ N , \pm Y , 7 E / \hat{A} \hat{O} c \%_o X \hat{o} o ; ' ([x \textcircled{Z} \pm \pm ' » . \hat{e} \bullet ' ! @ N , \pm 2(4 D \textcircled{O} \hat{O} c \% \hat{O} K X \zeta d E = y ! \& " \hat{O} X \zeta 9 d : \hat{E} B f » = \textcircled{O} \hat{A} \check{Z} N , " s \textcircled{E} F \hat{o} * U 1 K c 3 \hat{a} / 8 \%_o g . \hat{e} \bullet ' ! @ N , " V * U D \hat{A}' \ \textcircled{D} \hat{A}' \ \text{æ} E = y 2(4 \hat{i} \bullet D \textcircled{O} \hat{O} \%

' » E 4 ' ! @ N , \pm Y , 7 E / \hat{A} \hat{O} c \%_o X \hat{o} o \bullet Z @ \textcircled{E} \hat{i} \bullet E 6 \ \ - 8 \hat{a} c_{\beta} = \beta ! " c_0 = 0 ! " \tau_0 = ! J ! " " \sigma = ! J ! \beta \Gamma = \rightarrow \pm k x ! J ! \beta " 0 ! " 0 ! " 0 ! W \hat{\theta} \%_o o = ! J ! " " ! " ! " ! \hat{O}

ææ' » . \hat{e} \bullet ' ! @ N , \pm 2(4 D \textcircled{O} \hat{O} c \% \hat{O} X \zeta o \bullet - 8 \hat{a}

c_{\beta} = \beta ! " c_0 = 0 ! " \tau_0 = ! J ! " " \sigma = ! J ! \beta \Gamma = \rightarrow \pm k x ! J ! \beta " 0 ! " 0 ! " 0 ! W

\hat{\theta} \%_o o = ! J ! " " ! " ! " ! \hat{O} ææ' » . \hat{e} \bullet ' ! @ N , \pm 2(4 D \textcircled{O} \hat{O} c \% \hat{O} X \zeta o \bullet - 8 \hat{a}

2(4 i • DÛ@ÛÄ"

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< Z " ψ %o= y %o y %o- βo u %oO".è • ! @ N , i • >Füθ %o= αβ %o αo %o β! %oO"

DÄ' A e %o= y %o+ βo- ψ %oθ %oO"= ! J " λ = β! * %

Ö c ,

u %o= - (αβ - β) / β! y %o - (αo + !JO" / β! y %o - βo

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3i>î + β%f > DÄ' 3i - "Y' m@ @î±ÿ

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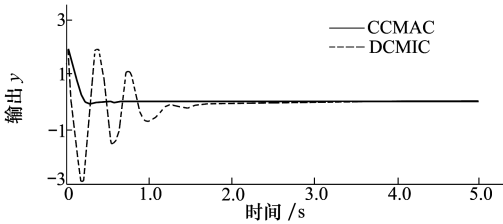
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Fü' / . A OF*D° < %s \ "' ».è • ! @ N ,

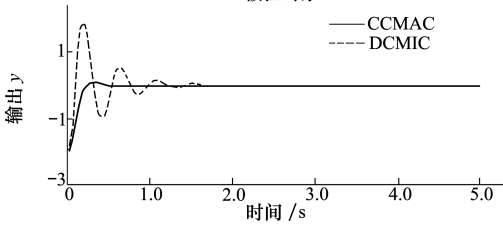
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ßŽ x ; zE ' / . A 80! ² "; k T » Y' Ö

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a) 被控对象 1



b) 被控对象 2

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Y' @ @î±Û c , ú&cα 6D° < ±±/ . A 17æ

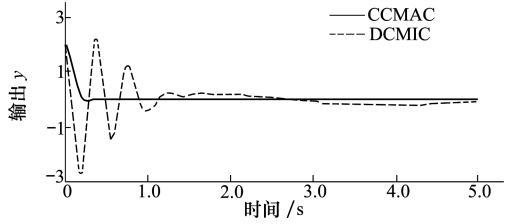
±±Û . T6* %

&! + β' + 0Z±±=ÛÛ &ÄŽ DÄ' 3i , 8

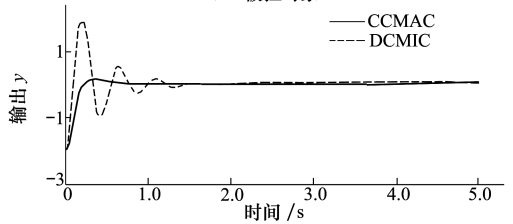
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- ÄK (Û2(4 ±±Û . ! T' / . A { ' w %o=

! # , % 9 %



a) 被控对象 1



b) 被控对象 2

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• α 6D° g ±±QÇÿ T "FòU, %9 ±±Ö c • "£ 3 XE6

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= Ö C*y ÿ • 1" , ÷ ï •

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U : 9 r i 1 M¼ ±± • S" ÿ • ±±%*U 8 "=ÛÛ

Ö &ÄŽ β' 0±DÄ' ! T - + m.g %

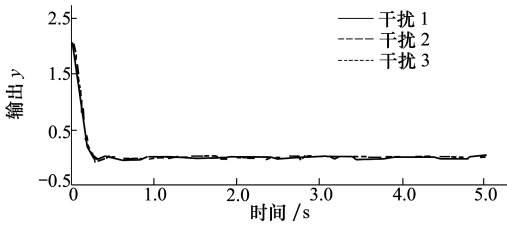
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&ÄŽ β' 0±DÄ' ! T 3 X - + x.m.g %

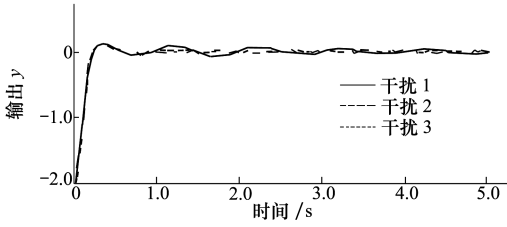
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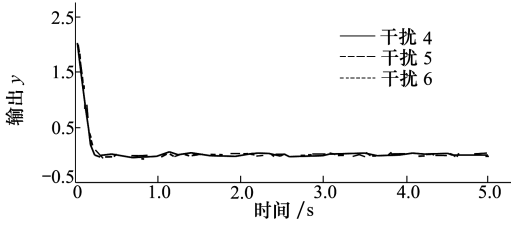


a) 被控对象 1

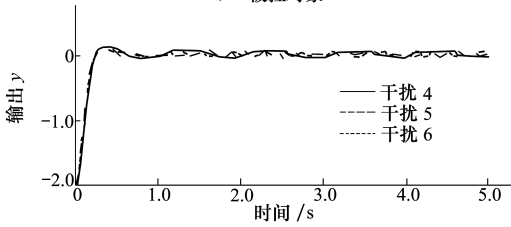


b) 被控对象 2

+ œ • S" Ÿ • 8=ØÔ &AŽ±DÀ' ' ! T



a) 被控对象 1



b) 被控对象 2

+ xœæ' Ÿ • 8=ØÔ &AŽ±DÀ' ' ! T

+ 1 + xZ=ØÔ &AŽ±DÀ' ' ! T 3i - â€=Ø
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 Á Ô c æ' % ; M4 Ô c 2(4 @®! m - *U ±±KzKœ-
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Öæ d z Å" _Lj _" Xü î" wUŽ dUuUwæwæi X> K-U > Ö=üç wK ð i ð=zk X> •zVp !•çiqLü üdUw æw ÆEJ&B =w! è 4& i wüüwæ .ÖŽç66 ö öö .•üçU •! öüw] UæiUi =zæU" 0! B" "%æoå xOK!

xÖæ @üLjk . è" ýLjk _" X zk >" wUŽ dUuUwæwæi X> >U > ö UqWæi •zVp ç Ö æzk Lj ö çUf = !•çU U •! i ç if w] .ÖŽi ù= zù d=Uçz!•q Uæz i ù= zù " 0! B" " å!" 00! 0

"Öæ Å ð Lj •z i" U U = ý i Ž X> • ! ç zù ö UqWæi Lj ð •zU LqWæi •zVp •! Å=ç Uç ð KÆEJf=zk if w] .ÖŽç66 dLj •z öüw] Uæi •zVp " 0!!" x" å B0 ! K3 !!

Öæ; dÜ _" i ü @ _" ý ç wæi X Ž ö UqWæi >Lü wqç=zk •zVp •! zù wæz Å=ç Uç if w] ü ç ç z' ç z öüüUwæ Ö Uf .ÖŽöüK w] UæiU" 0! B" " xå 0" K0 "

Öæ X U . " ; d jk ; P" Å=ç Ž ö UqWæi Öfzlj æi iü dLü •zVp •! U U •! ð •z ç Uç if w] æw z' ç z Ö ç ü wæ z •zVp H Uç Lj çz qüwü Uü dUæ z .ÖŽç66 dLj •z f & ç wæi " 0! B" " x" %æoå @ K&B

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Öæ; çk P" ü Ljk è" ð Lj > Å" wUŽ ••&ü wö UqWæi Öfzlj æi iü dLü •zVp Ö æzk !•ç U è 4& ö ç ç ç Uæ=çk @fq ç•zæü ÆEK dæi æw çz qüw •z wæz Uç Lj zù wæz Vf .ÖŽ ð •z ç Uç Öfzlj æi" 0! Bx" @ å 0 K B"

B! Ö i çk X " Å=ç _" @üLjk •Ž ••&ü wö UqWæi Öfzlj æi iü dLü •zVp !•ç Å=ç Uç ð KÆEJf=zk if w] .ÖŽçz wæz Uæz U •ü çK z U •! ö UqWæi •zVp Lj i çk U è ç ü =çk" 0! Bx" 0 å OK x

B3 Ö _Lj ; " ü Ljk .Ž ••&ü w X> è ç > æ wæi •zVp •! ð •z ç Uç if w] æw z] • , Öfzlj æi Lj > ü ç , zù wæz Væ >U > ç ð ü dU ð w •ç .ÖŽç66 dLj •z ð ü dU ð w •ç Lj Å Uç=çk if w] " 0! Bx" 0" %æoå x" @K

B3 Ö ö Lj =ö" H •z U @ i U w f i i" wUŽ è ç ü B f i U Lj ••&ü w Å Uç=çk K-U > X> è ç > æ wæi •zVp .ÖŽ ö ü w] UæiU" 0! B" x å B0 B K300

Û Ysäã Ü•9SYäã ÷ s¥Ys 9 äYs • ' 9çã s¥ ÷ s¥Y¥éséç ÷ J9-9PÄ—çYp 9 s•ã ç ; d•ü .üç" H ; d ç d ç" Hü• . ð Lj kü•

%çz wüüw •! è ç ü =ç z Hü=ç Lj ü Lj •zVp " ð •ç wæz è • f w ü d z æ U z æ ç ç f" î ç Lj @! @" d=ç U

Û çY-9PÄ è ç U ü U •! ç •z ç Uç f w] " U ç •z U UqWæi ü zVp ü d] = ç ç ç > ç wæ ç Lj ç Ž è ç w f" wü ü z wæz ü ü ü dUuUwæwæi] • = ü ç wüüw" dæid = @æiU ç w w æ w ç ç k z U f w] ç •ü wü w •ç wæ Lj ç z qüw U w Lj f wæ Ž dÜ" wæ ç ç k z U f w] ü Lj & ç q Lj æw æ w ü dUuUwæwæi] • !•ç æz çk ü zVp ç Ž ö wæ ç ç k z U ç •z ç Uç f w] dU ü ç z' ç z ç Lj w ç Lj ü z] • , > f zlj æi" wæ ü dUuUwæwæi ç Lj w ç Uç ü ç z' ç z Lj !U wæ K U Lj f=çk Ž ö ç •z U UqWæi ü zVp] wæ = ç ç ç > & f ü] & ç ç k wæ ü z wæz ü ü ü dUuUwæwæi] • æw wæ U UqWæi > f zlj æi ü dLü ü zVp wü d z æ U Ž d] wæ = ç z q ç z wæ ç wæ ç ç k z U f w]] • Lj ç z f ü wæ = wæ z !•ç Uæz Uæ ü w f w] •ü wü w •ç ü zVp ç k Ž ç Lj ü z wæ ! wæ ! U wæ wæ f w] ç z ç wæw " ü ç z' ç z ç Lj w ç Lj ü z] • , > f zlj æi Lj ç •w ç > w & •& ç ü > Ž è z U f" wæ wæ = ç f •! wæ ü • > ••q f w] = ç ç ç > & f ü wæ = ç k Ä f Lj ç z ü wæ ç f Lj ç ü Uæz ç ü w dLü >] ç wæw wæ || ü wæ z •! wæ ç ç ç >] wæ > Ž

pæe s-çã ü z wæz ü ü ü dUuUwæwæi] • + ç •z ç Uç f w] + U UqWæi ü zVp + > f zlj æi ü dLü ü zVp + ç & ü wæ +ü • > ••q f w] + ü zVp ç + f Lj ç z ü !ü z wæ z