

µāÇā Óyó ÓÑ# SéÑ# Óyú# #/ā

' » N , ï 507 E/ Á Ô c +±7b g Í D²(4 -A/£

/; "8 w6 ' V wK •

%-D G T " 7W " K•"K,>->-¶ œ@! !@o

...œ@Áb ÖBLDª N • N N=y• N=yDð8 Z7bg ñ +±J J+È- w 7bg"xA ¹ w È- , L
+± J[@â x - f › *b ÖBLDª N • +±3ñ = ÷ %ø) 3 w /ø³ =ØÔ &AŽ±ï 50 N , w' »
¶Uç çUJN , ï 507 E/ Á Ô c)3 @ç@î³ È- Ô c +±N , ï 507 E/ Á Ô c 2(4 wU50;~7bgD°TKc
Bð• Ö±±ò â 8 w& Í D²(4 E=y³ • , , L w È=•; N , ï 507 E/ Á Ô c æ" 3 Í D²(4 S ê ù
O! @ ýP] ! @wÈ(Ý³ *b ÖBLDª N • +± ELP 1ëÓ Ô c w¹@î³ A Ô c 0f" +±6 u T

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+±P KcÔc &AŽ%BLDª N • 7 CØ • " , - g :
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E G] 7bg z 4) Ý • +±%*U" ' Kè ' /øBLDª
N 2(4 1è) +±• " N , "e>ñ±Ô c x â - - Kè
Dè] µª +±u È %

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c • "È(Ý³ *b ÖBLDª N • +± ELP 1ëÓ Ô c "
' æ" /8 ÈC"TD°P "s*^ » Ô c ï • ' Ç"- -
Í D²M%SD°± + ([003 ½³ - 0v(ÝAŽ&BLDª
N 2(4 +±ž ú "Fð*UN1÷7 E/ Á èçÖ Ô c æ" @è
@ÍÔ c • "&- 0vL<3ì T 2M6 - Ç+±¼c u È "
sA æ" Ô c • 4 ±D°g : o "59A 9 d ...US ê
: Bâ+K MÅ' ([Öý ' - .ú z Nµf ñ æ" "£ '
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T "s È › ' 0Ä" @@ÍÔ c • KèÓD°T " /8 Z ÈKr
Á*U: G + ([x00;~ f 1Ts +±f T(Ü7 " " /ø³
B' f 1Ts ; BLDª N • +±• " N , "3 ½³ 2(4
: 9 GÓ2(• & Í D² Ç T¹ ELT+±ž ú "£ Fò

*U7bg>yÉLO %øg z Nµf' ñ ' ¼c G † È- + ([
"Ò /ø³ Í D²(4 +±• " N , "3 ½³ G † È-
+±Ô*L g)3 "£ Á*UN1÷ èçÖ ; .ç 3ü4-4 èçÖ Ô c
4 5+±æ" &BLDª N 2(4 E=y, , L 3 ½"4 È=•
; uE èçÖ Ô c 0f" È(Ý2(4 +±DÀ' D™
EL&→] C C WÀ' D™ "6* L 6 u ¼c G † È- "
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9 d4g] 6 uO¹@i%

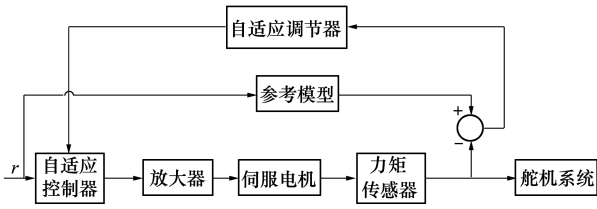
µ &*b ÖBLDª N • +±Ô c • @@K MÅ' Y '
ý ' ' » N , ï 507 E/ Á Ô c +±Ô c • @@îæ" %
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- " 59& » L->@ ELú Á+±7bg Í D²(4 6 D°ª
+±E/ Á T %N , ï 507 E/ Á Ô c 2(4 +±Ô c • ï •
f › =ØÔ &AŽ±! T¹ (Ü° +± C59: ÚA0
j %û59È gBLDª N 2(4 +±E/ Á6* È %

Ö B²/ Ç)3 @ç 7 E/ Á Ô c 2(4 4 ±

N , ï 507 E/ Á Ô c \ - .ú =&ì+±7 E/ Á @@
æu ")3 @ç -mR ó592(4 C "@@î8 ¼0-". "6 ñ
KA+±Á*Uz œ °%N , ï 507 E/ Á Ô c +± 4 \ á
@@ÍÔ c • 1 ï • N • g c ñ Ä=ØÔ &AŽ±DÀ' j
6*] C C W 50 N , +±DÀ' "£ ñ ÄK (Ü2(4 +±m

6 \$ - 7! 6*y %N, i 50 Ô c • EÐðã . ú NµCDÀ' ú Nµ' ¹ = " U Á *U 7 6 ,m! - + ± \$ % ð J \$ i %

Á *U » BLDª N • + ± N, i 507 E/ Á Ô c 2(4 + ± 4 ± - + ß m.g % ° h > @ ^ i 50 N, & A Q(4 1 7 E/ Á A 07 - g ± 3 ñ = " £ Z A Q(4 2 = Ø Ô & A Ž¹ A 0 Ô c • % @ @ Î Ô c • # " > @ o BLDª N 2(4 \$ B à B² / Ç) 3 @ Ç' 9 # 2(4 K (Ü ME? * • g • Ë ME? * • %



+ ß œ BLDª N • N, i 507 E/ Á Ô c 2(4 s +

50; ~ 2(4 æ / 8

$$\dot{x} = Ax + Bu = Ax - Bw$$

$$v = Cx + Ju = Cx - Jw$$

$$w = \phi \%_o "x "r o \%_o$$

< Z "x g n 4! 'ã . > FÜ "u ¹ v g z > m 4! DÀ' ¹ DÀ' > FÜ "w g ú Nµ C + ± m 4! DÀ' > FÜ "φ \%_o = • .g ý W > FÜ 80 • %

- É & » \$ B à 8 D : 0v <

$$\eta \%_q "t_\beta o = \int_{t_1}^{t_2} v \, dt - r_1^0 "t_\beta > t_1 \%_o$$

+ ± (, ú Nµ \$ w = φ \%_o "x "r o " ... U • e • δ " - Ä \%_o < + ± m 6 ? x \%_o \%_o "t o \$ B à 8 D : 0v <

Ä x \%_o Ä < δ \%_o Ä x \%_o + r \%_o Ä o " Ft > ! \%_o o œ œ & » B² / Ç 2(4 " € \$ B à

$$\frac{d}{dt} x \%_o ! " F w = \phi \%_o "x "t o \%_o$$

" F / ' K (Ü 2(4 g # = D ß B² / Ç + ± %

& » # = D ß B² / Ç 2(4 " 8 A " B ¹ • 6 * Ô " A " C ¹ • 6 * > i " x " F ME? * •

$$H \%_o = C \%_o J - A \sigma^\beta + J \%_o$$

g Ri • Ë * • + ± r > @ Ž # \ á ... U Ë - Kb K " L ; Ë • Ç & / - Kb P " - Ä

$$PA + A P = - LL$$

$$B P + K L = C$$

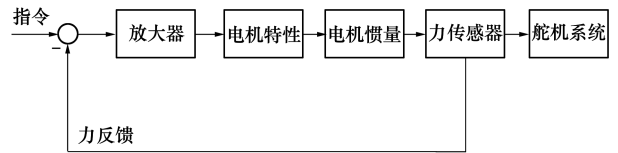
$$K K = J + J \%_o$$

= / ø # " H \%_o o g Ri • Ë - Kb * •

† BLDª N 2(4 i 50 N,

i 50 N, \ - W) 3 + ± Ô c N, " E ^ - Ä N, i 507 E/ Á Ô c 2(4 : 9 » £ • < + ± Ô c " ° : L - > @ & T 6 * 4 4 E = y • % A Q(4 ¹ i 50 N, x K! T 6 * + ± - 7! T ^ 7 E/ Á g ± @ i " T 6 * - 7! T / 8 Ó * ^ A Q(4 ¹ i 50 N, x K! + ± ã . A > FÜ CDÀ' A > FÜ' Ó FÜ " 7 E/ Á g ± 6 ü < | + ± æ > • C! Ý Ô c , " - 2(4 + ± T 6 * 4 4 D è] C Ø D ð L H T 6 * 4 4 @ %

* b Ö BLDª N • + ± i) 3 4 ± - + 0 m.g % û + Z , 8 ' " * b Ö BLDª N • h > @ ñ = 2 ä y Ø Ä k T • & g : * b g & Ë M L • & FÜ N • & Ø D™ , • & b g ° %



+ 0 œ * b Ö BLDª N • 4 ±

@ @ 7 E/ Á Ô c • # " 3 BLDª N 2(4 0 - C g - 8 • < ä

$$y_p = k_p \frac{Z_p \%_o o}{R_p \%_o o} \%_o + d_u o \%_o$$

< Z " u_p " y_p 3 X g 2(4 > i " x + ± DÀ' ; DÀ' " k_p g - P M ³ Ë + ÷ " Z_p \%_o o " R_p \%_o o \ 2(4 W - + ± Ü 3 0 Ä } GM i < " d_u = • .g DÀ' + ± ÿ • \$ %

2(4 + ± i 50 N, = • .g g

$$y_m = k_m \frac{Z_m \%_o o}{R_m \%_o o} r \%_o$$

< Z " y_m g i 50 N, + ± DÀ' " r g - 7! 6 * y + ± i 50 DÀ' ' \$ %

Ô c , 4 \ @ @ È / € + ± Ô c • " - Ä K (Ü 2(4 \%_o Z + ± m 6 \$ 6 * y " £ A 2(4 + ± DÀ' j 6 *] C CW 50 N, + ± DÀ' % g Ë (Ý 7 E Ô c , 4 ¹ ; L • @ i ; + ± L - > @ & 2(4 ¹ i 50 N, \%_o - 8 t @ ä

ß o Z_p \%_o o \ N • g m + ± @ ü ç = v N Ä - GM i < " R_p \%_o o + ± N • + ± 7 - > * y g n " ME? * • G_p \%_o o + ± % & N • n^M = n - m %

0 o G_p^- ß \%_o o U • \%_o o ! J " δ_1 + ± 80! 7 ? ½ " δ_1 \ e • %

o Z_m \%_o o " R_m \%_o o \ N • 3 X g q_m " p_m + ±

@Ûç =wNÃ- GMi< "£,%&Kc n_m^M = q_m - p_m ; G_p %o
±±%&Kç%ov" n_m^M = n^M %

ï 50 N , L->®f > =ØÔ &AŽ±±• " N , ÷2(
4 >®o ±±- \ 4 4 E6 " UBLD^a N • Dý=y # " g H
B^2AFüj 6* < + Ô g DÀ' *b , g ! 2 B! Æ' g :
*b g DÀ' *b , g ! 2 ! Æ' ' Ë÷÷K %o %f > '
([BÛ' 3 ï 50 N , @ëj 6 Kç(4 " Ä] : X Ô
c • ±±*b ÖBLD^a N 2(4 ±±)3 ME?* • ±±@ÛÄ
É g

$$G_m \%o = \frac{\textcircled{R} \text{ B!}}{\%o + \text{B}J0o \%o - J0's + \text{B} \times \text{B!}^o \%o}$$

ú±=ØÔ &AŽ±±0- C N ,

úŽÛ g : *b g

BLD^a N 2(4 ±±g : *b g ^1 FÜN • *U
- Kc T(Û7=•g "& » 6,%/ ' *b g "£ ME?* •
=•g g â

$$G_B \%o = \frac{\text{B}}{T_{d,s} + \text{B}} \%!$$

< Z " T_d g #K! e • %

úŽ±±3ì T ì k

3ì T ì k ±±*U' & Ô c @ÛÄg DÀ' ±±*b g Ô c
\$ E=y r i ^1 ì (' k T "&c; OžÕ,! "n È- È-
*b g DýÕ * * 3ì T ì k ±± < 3ì T 2M; " 3
3ì T ì k >óg)3 ±± , (Û7 "£ Ë÷÷g â

$$K_f = \frac{U_{\cdot \ddot{u} \ddot{v} \ddot{w} \ddot{x}}}{U_{\cdot \ddot{q} \ddot{l}}}$$

úŽÛ f 1Ts

f 1Ts *U » ,! "n È- *b g ^1 7bg K! ±±È- í D^a
4@ß "\$ K' È- P M^3ß FÜ% * * f 1Ts YCØUFü^1
È- ME^D#NDß8 ±±ž ú " Dp>ó@Ñg f 1Tm M
E?È- ^1 š D^y Ó x K! ...U3ì T! , 2(â

$$T_L = K_L \%o - \theta_{B0} \%B0$$

< Z " K_L g f 1TG Ó2(• "θ_0 g 7bg ±±DýÕ>ý Ó %

¼ Ô c • @ÛÛ

í D^2(4 *^ » ' NA &C*y ÿ • &- 0v±±
ž ú "U c ^ Dð8 Z e G' (Y Ä \ (YÄŽ^Kzç ^ 3 2(4
±±QÛ T ^1 C CWT6* %g ^3 "µK'E È : 7çYÄŽ"Y

7 @ÛÛ WSL†. = ' - • ±±N , ï 507 E/ Á Ô c
• "£ Z @ÛÛ†. = ' - • K} c C CWM U -
WM D^>±±80! ^2 "û59 6 u] E- z ! D^T ±±
, Û. \ 8Ž"ý P 2(4 ±±QÛ T ^1 C CWT6* %

f > 2(4 C CWM \$ " 3 Ô c • @ÛÛg -
8 • < â

$u_p = \theta_1 \%o \omega_1 + c_1^M r + u_a \%B o$
< Z "u_a \ - D^2 ÖDÀ' " *U' f ±±2(4 ±±T6* £ A
: K¼# K! ±± C59 C "/ x g L†. = ' - • % .
%B < S' %B o < Ä

$$e = \frac{\text{B}}{c_1} G_m \%o \%b_1 + u_a + d_{B0} \%B \times o$$

ææ7 E/ Á Ô c ±±, 4 \ E6 u_a % - Ä K (Û2(4
±±m6 \$ U d_B = ! ±±ò â 8 . 6*y "£ A %b_1 +
d_B o & e ±±ž ú j 6* < %

E6 u_a = - C %o "£ Z C %o \ > @ÛÛ†±•
F ME?* • % & » Y ^ ±±2(4 " > @ÛÛ†±m6 /
Ç= ' - • ±±Kó5 ^ 8 â

$$C \%o = \frac{Q \%o}{\text{B} - \frac{\text{B}}{c_1^M} G_m \%o Q \%o} \%B^o$$

< Z " Q %o U m6 / Ç ±±6)3 ME?* • ^2 C " F
%o < Æ=

$$e = \left[\text{B} - \frac{\text{B}}{c_1^M} G_m \%o Q \%o \right] G_m \%o \frac{\text{B}}{c_1^M} \%b_1 + d_{B0} \%B o$$

*^ 7 < Ä â

$$\Delta e \Delta_{>} j \Delta h_m \Delta_B \% \Delta \theta_1 \omega_1 \Delta_{>} + \Delta d_B \Delta_{>} o \%B B o$$

< Z " Ä M Ä_{>} =•g | M | ±±7-) *y " Ä M Ä_B =•g
L#] • /x / 3 "h_m \ ME? * • g B -

$\frac{\text{B}}{c_1^M} G_m \%o Q \%o \pm \pm 2(4 \pm \pm 6 \text{B} \acute{u} \acute{A} \%(\acute{Y} U \pm K M \acute{A}^{\text{TM}}$
C g E6 - W • F ±± Ç ±±6)3 * • Q %o - Ä h_m
±±L_B 80 • - < "

E6 \$ " GMi<
 $L \%o = s + "$ %B o

ææf > ¶Uç > ÛN , @ÛÛ; g G_m \%o Q \%o g
Ri • È ME?* • % Ç v È - ä . > FÜ

$$\begin{cases} \omega = r v_B y_p v_0 \\ \xi = \xi_B \xi_o \xi \xi_x \dot{O} = L^{-\text{B}} \%o \omega \end{cases} \%B o$$

ææÇ v ä . > FÜθ = k_1 "c_B "d_1 "d_B ÒE6 \$\$
" • D %o = s + "8ä Ä\$ " \$ g

$$\begin{cases} v_B = \frac{u}{s + \dots} \\ v_0 = \frac{y_p}{s + \dots} \\ \xi_B = \frac{r}{s + \dots} \\ \xi_0 = \frac{v_B}{s + \dots} \\ \xi = \frac{y_p}{s + \dots} \\ \xi_x = \frac{v_0}{s + \dots} \end{cases} \quad \%0! o$$

XC CWØ X { M³%0! @ o; P M³%0! @ o• S È- 4 " £ Fõ^U: 9+±KcBðr i "E =y &! 3 ½ %α € , ,L Ž # ; 4 È - =• ß¹ + x²+ m.g % =• Ô† , ,L Ž #

È- 4	È- 4	È- 4	• ÔDýÕ	• ÔDýÕ
• <	r i Ő]	M¼ ð@	• <	r i Ő]
• S	ß!	0!	KcBð	0!
• S	ß!	0!	KcBð	0!
• S	ß!	!	KcBð	!

œœE6 7 E/ Á Ô c ,

$$\begin{cases} \dot{\theta} = \Gamma \xi e \\ \Gamma = \dots \\ e = y_p - y_m \end{cases} \quad \%0\beta o$$

< Z "y_m g i 50 N, DÀ' "y_p g ÈKr2(4 DÀ' "T g i • >Fü"3 ð¹ ξ + ± = Dë< ,

$$u = \omega L^{-\beta} \dots \quad \%00 o$$

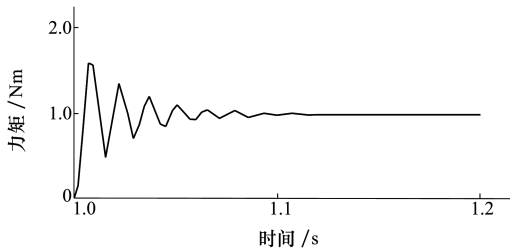
Ä Í D²(4 ± ± Ô c , g

$$u = k_1 r + c_{\beta} v_{\beta} + d_1 y_p + d_{\beta} v_0 - e_{\beta} \sum_{i=\beta}^x \gamma_i \xi_i^0 \quad \%0 o$$

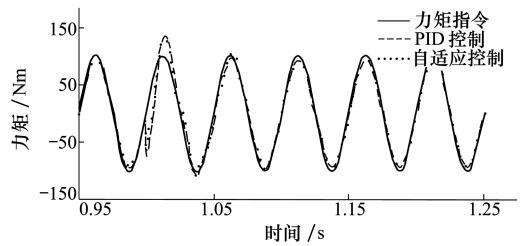
‡ , ,L 4 È

f) z ' ' /ø + ± 2(4 Ô c œ s + ÷ @ @ ð ± Ô c 0Ä' "U Xö Äö > ð ð ü ÷ (Ü ° 8 ' /ø³ ; WÍ D² 2(4 ± ± Ô c s + %

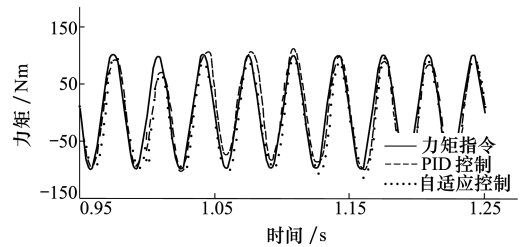
, z KcBð \$ 8 "i 50 N, DÀ' ; 7 E/ Á Ô c • + ± DÀ' &! + - + m.g % , 8 ' 2(4 KcBðú ÁELÓ6* L\$ Bàí D²(4 ú Á ELT + ± @ o %



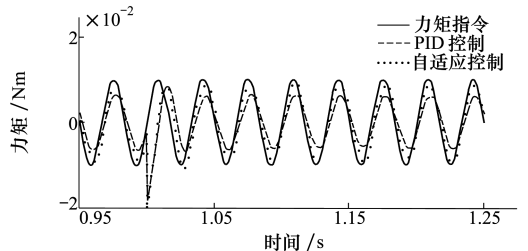
+ œ, z KcBð \$



+ œÈ- 4 ß! ¶] "0! @ • S \$ " 7bg 0! ¶] KcBðýÕ



+ "œÈ- 4 ß! ¶] " ! @ • S \$ " 7bg 0! ¶] KcBðýÕ



+ œÈ- 4 ß! ¶] " ! @ • S \$ " 7bg ! ¶] KcBðýÕ

U 8 D ò â 8 & 7bg Í D²(4 E =y , ,L ãbg U , ,L - ø ß # E =y KcBðýÕ "BLD³ N 2(4 3

, ,L 4 È =• ; "50; ~ 7bg KcBð • Õ # " & » - +

