

631.372 + 631.312

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: 72310,

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Internet

[www.tsau.edu.ua/nauka/category/dissertation](http://www.tsau.edu.ua/nauka/category/dissertation).

« 27 » \_\_\_\_\_ 2017 .

..

« - ») «push-pull» ( ) . -  
 , , , «push-pull» ( -  
 «push-pull» , , , -  
 « » (2011-2014 , 1-2009 28.04.2009 . -  
 0111U002562) « » . -  
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 ; - «push-pull». -

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«push-pull».

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[2, 3];

[4, 8];

[5, 6];

[1, 5, 6];

« - » [1 – 9].



«push-pull»: )

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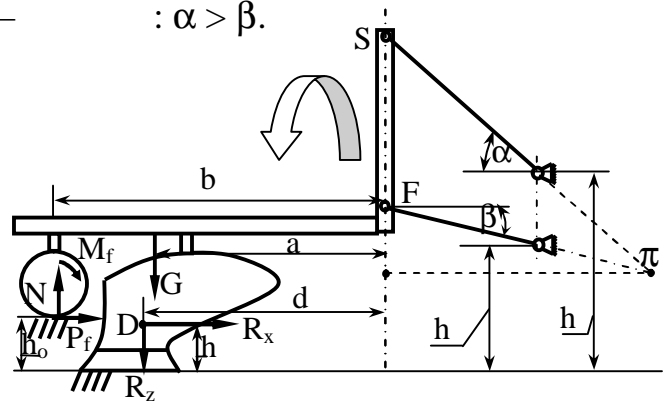
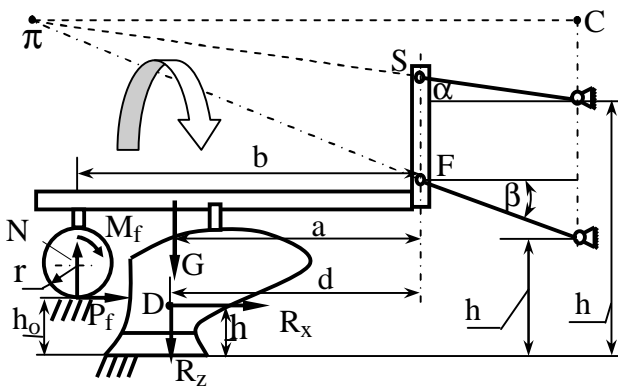
- -160)

2

$\beta$  ( $\alpha < \beta$ , . 1).

( ) (  $\alpha$  )

:  $\alpha > \beta$ .



. 1.

: )  $\alpha < \beta$ ; )  $\alpha > \beta$ .

( . )

( . 1 )

1)

(R) (Rz)

» - . D ( . 1); 2)

(b)

3)

( )

« »

«

( , . 1);

(d) (  $\approx d$ ).

( .  $\pi$ , . 1).

$\alpha < \beta$ :

$$N = \frac{G \cdot (\pi - r \cdot \cos\beta) + k_0 \cdot B_p \cdot h_0 \cdot [0,2 \cdot (\pi C - d - r \cdot \cos\beta) - h - \pi C \cdot \operatorname{tg}\alpha + h]}{\pi C - b - r \cdot \cos\beta + (h + \pi C \cdot \operatorname{tg}\alpha - h_0 - r) / f} \quad (1)$$

$\alpha > \beta$ :

$$N = \frac{G \cdot (\pi + r \cdot \cos\beta) + k_0 \cdot B_p \cdot h_0 \cdot [0,2 \cdot (\pi C + d) + h - (\pi C - r \cdot \cos\beta) \cdot \operatorname{tg}\alpha - h]}{\pi C + b + [(\pi C - r \cdot \cos\beta) \cdot \operatorname{tg}\alpha + h_0 + r - h] / f} \quad (2)$$

(1) (2)

, ; k -

: r -

, / <sup>2</sup>; B<sub>p</sub> -

, ; h -

, ; h -

, ; h -

( )

« »

- «

» - ( . D, . 1);

r -

, ; f -

; π ,

( . 1).

(1) (2)

: G = 1...3 ; = 0,55 ; r = 0,82 ; k = 50...80 / <sup>2</sup>; = 0,35...1,05 ; h = 0,22...0,30 ; d = 0,4...0,8 ; h = 1,15...1,40 ; h = 0,4...0,8 ; h = h / 2; b = 0,5...1,5 ; r = 0,23 ; f = 0,1.

. 1 ,

$\alpha < 0 \quad \beta > 0$

:  $0 \leq \alpha < \beta$ .

(β).

N .

β

10 ,

0...3 ,

$\alpha < \beta$

( )

:  $0 \leq \alpha < \beta; 0 < \beta \leq 8$  .

$\alpha < \beta$

(  $\alpha > \beta$  )

N = f(b; d)

b d -

$\alpha < \beta.$

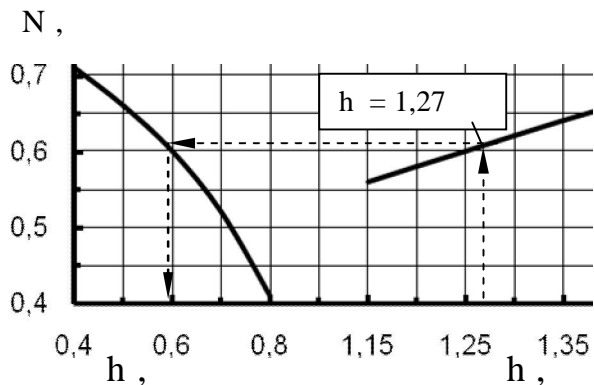
h h . ,

( . 2 ).

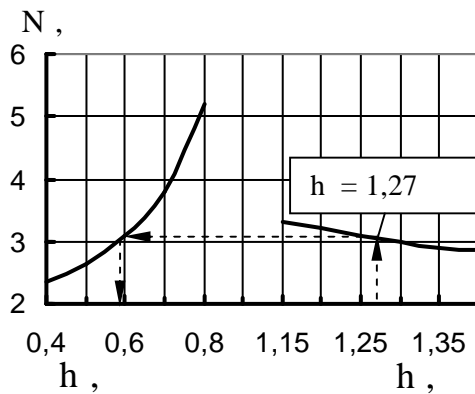
(h )

N

( 0,4 0,8 )



)  $\alpha < \beta$



)  $\alpha > \beta$

. 2.

(h )

(h )

$\alpha < \beta$

(h )

(h )

$\alpha > \beta$

( . 2 ).

h h

1)

h , h . ,

2)

(1) (2)

3)

; N

$N = f(h)$

4)

r h h ,

$\alpha \beta$

SF ( . 1)

:  $SF = h - h + r \cdot (\cos\beta \cdot \text{tg}\alpha - \sin\beta).$

-160

«push-

pull»

( )



( ) ( ) , -160 -

, , . , -

; 1) , -

; 2) ; 3) -

; 4) -

« »; 5) -

; 6) , ;

7) , , , ;

( $\alpha$ ). -160.

- ( .3 - , .3 - ),

- . ( .  $\pi$ , .3 ) ,

( .3 ) - .  $\pi$  ,

(R ).

Y<sub>1</sub>O<sub>1</sub>X<sub>1</sub> ,

V ( .3 ). , YOX.

X<sub>s</sub> (  $\varphi$ ). -

X<sub>s</sub>  $\varphi$  ,

Q Q . , ( .3 ): -

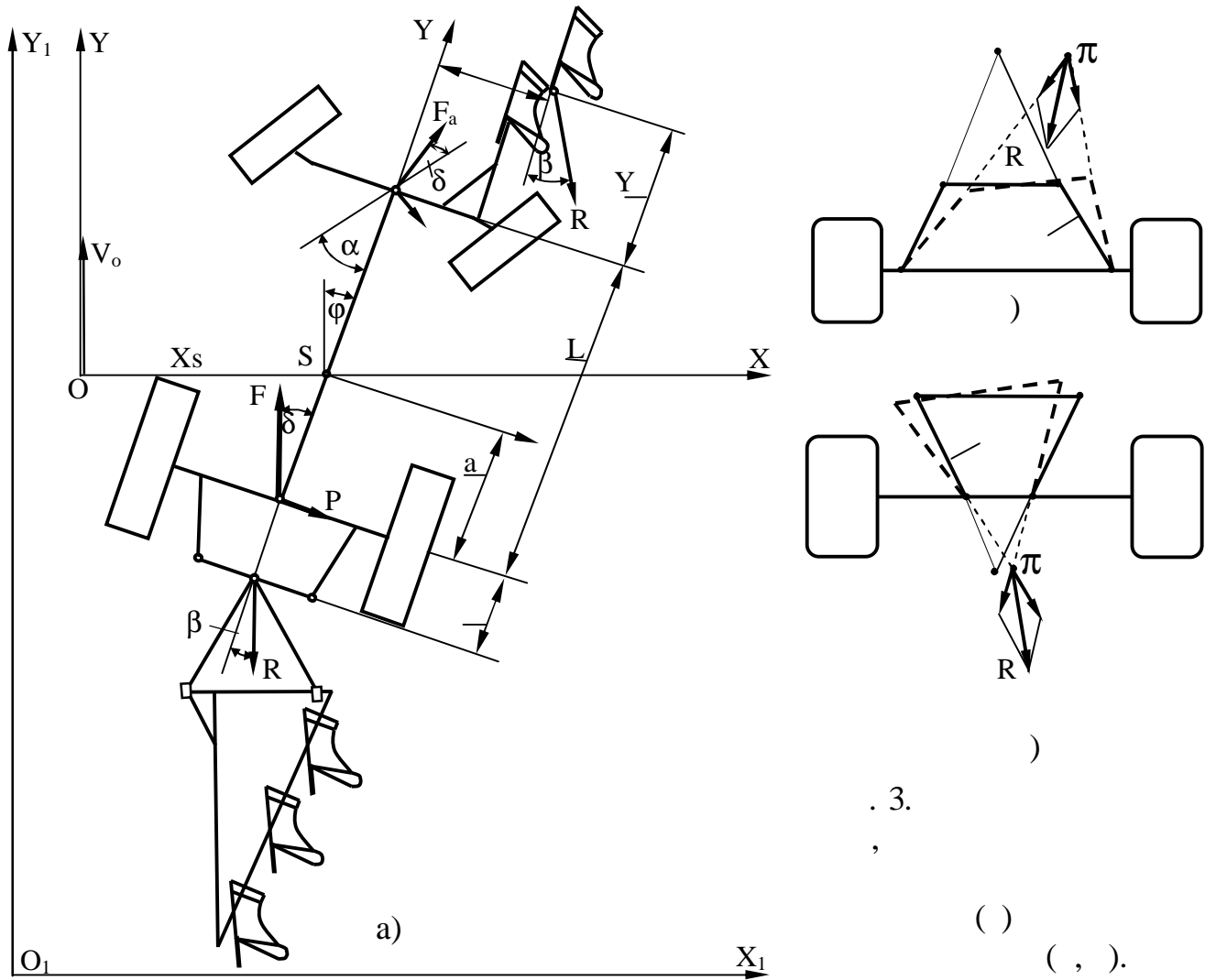
- F , -

- F<sub>a</sub>  $\delta$ ; -

$\delta$ ; , ;

- , R , -

- S Y  $\beta$ ; R ,  $\beta$ .



$$\left. \begin{aligned} A_{11} \cdot \ddot{X}_{ST} + A_{12} \cdot \ddot{X}_{ST} + A_{13} \cdot \ddot{\phi} + A_{14} \cdot \ddot{\phi} &= f_{11} \cdot \alpha + f_{12} \cdot \beta_n + f_{13} \cdot \beta_3; \\ A_{21} \cdot \ddot{\phi} + A_{22} \cdot \ddot{\phi} + A_{23} \cdot \ddot{\phi} + A_{24} \cdot \ddot{X}_{ST} &= f_{21} \cdot \alpha + f_{22} \cdot \beta_n + f_{23} \cdot \beta_3 + f_{24}, \end{aligned} \right\} \quad (3)$$

$$\begin{aligned} A_{11} &= \dots; & f_{11} &= k_a; \\ A_{12} &= (k_a + k - F_a - F)/V_o; & f_{12(a,b)} &= n \cdot b \cdot k \cdot h; \\ A_{13} &= [(k - F_a) \cdot (L - a) - (k - F) \cdot \dots]/V_o; & f_{12(c)} &= 0; \\ A_{14} &= -A_{12} \cdot V_o; & f_{13} &= n \cdot b \cdot k \cdot h; \\ A_{21} &= J_a; & f_{21} &= (L - a) \cdot k_a; \\ A_{22} &= [(k_a - F_a) \cdot (L - a)^2 + (k - F) \cdot a^2]/V_o; & f_{22(a)} &= n \cdot b \cdot k \cdot h \cdot (L - a + Y); \\ A_{23} &= -A_{13} \cdot V_o; & f_{22(b)} &= n \cdot b \cdot k \cdot h \cdot (L - a - Y); \\ A_{24} &= A_{13}; & f_{22(c)} &= 0; \\ f_{23} &= -n \cdot b \cdot k \cdot h \cdot (\dots + \dots); & f_{24} &= n \cdot b \cdot k \cdot h \cdot X. \end{aligned}$$

$(\dots)^2$ ,  $J_a - \dots$  ( $\dots$ )  
 $(\dots S, \dots 3); k, k - \dots$   
 $\dots / \dots; n, n - \dots$

$\beta$ ;  $h$  – ;  $b$  – ;  $k$  – , ;  $L, a, Y, X$  – ( .4 ).  
 (4)  $f_{12}, f_{22}$  ( )

.3 , (b) – , .3 , ( ) –

«1+5»; «2+4» «3+3»; 2)

( ) ; 3)

; 4)

; 5)

( ) ( )  
 ( )

$\beta$ .

[W ( )],

$$W(\beta) = \frac{F_1 \cdot \beta + F_0}{\beta \cdot (C_2 \cdot \beta^2 + C_1 \cdot \beta + C_0)}$$

$$F_1 = f_{22} \cdot A_{11}; \quad F_0 = f_{22} \cdot A_{12} - f_{12} \cdot A_{24}; \quad C_0 = A_{12} \cdot A_{22} + A_{11} \cdot A_{23} - A_{13} \cdot A_{24};$$

$$C_2 = A_{11} \cdot A_{21}; \quad C_1 = A_{12} \cdot A_{21} + A_{11} \cdot A_{22};$$

d/dt.

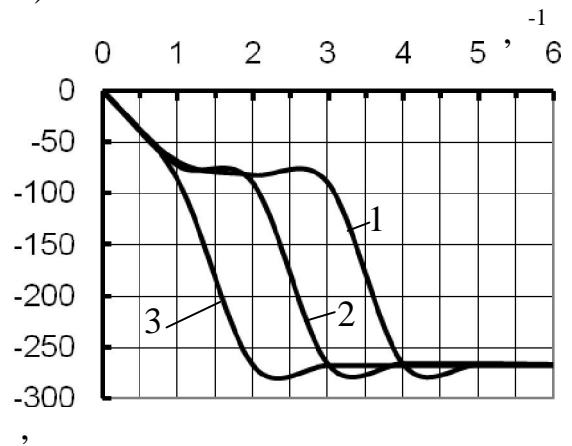
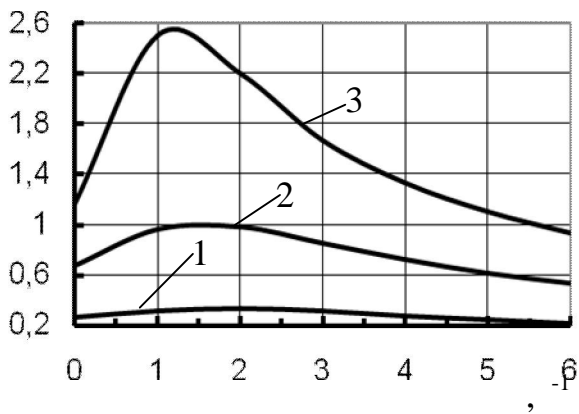
«1+5»

( ).

«3+3».

1 3

( .4 ).

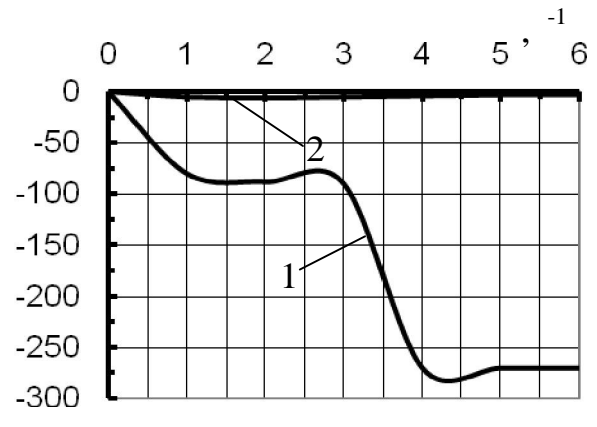
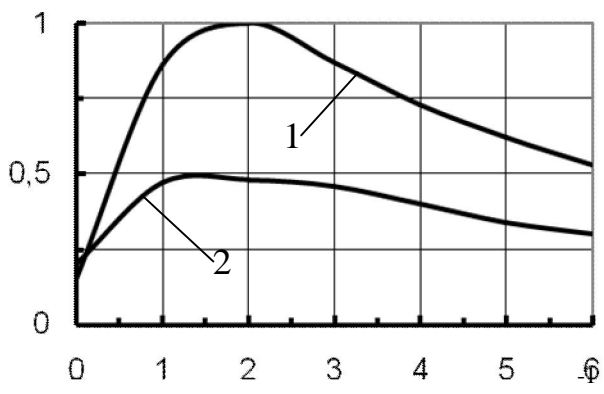


.4. ( ) ( )

: 1 – «1+5»; 2 – «2+4»; 3 – «3+3».

,  $= 1,5^{-1}$  ( 1 3, .4).  
 «2+4»  
 ( 2, .4),  
 «3+3».  
 : 1,2...2,8<sup>-1</sup>.  
 «3+3».  
 «1+5» , «3+3» -  
 «2+4» ,  
 0.4,  
 0...1,5<sup>-1</sup>.  
 2 , -4 ( «2+4» ).  
 - ρ = 175 , ρ = 130 ,  
 : ρ = 130 ; ρ = 175 .  
 V = 1,5 / ,  
 - V<sub>o</sub> = 2,5 / .  
 1,95...2,50 / (7...9 / . )  
 2,225 / , 8,0 / .

1 0,2<sup>-1</sup> ω = 1,0...2,0  
β) 1,5...2,0 ( .5).



n = 2; n = 4; = 130 ; = 175 ; V = 2,225 / (8,0 / )  
.5. ( ) ( )

: 1- ; 2-

« » (0...1,5<sup>-1</sup>)  
( ) ,

, , ( )

, , « » . 3 , (Y , . 3 )

$$Y = L - a . \tag{4}$$

$$W_1 = k = \frac{f_{24} \cdot A_{12}}{A_{12} \cdot A_{22} + A_{11} \cdot A_{23} - A_{13} \cdot A_{24}} . \tag{5}$$

k -  
( ) .  
(5).

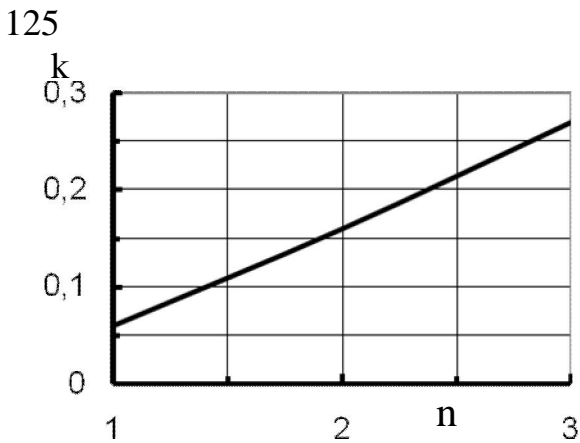
( ) , (V), (ρ ).  
 (n) (5) n = 2, = 115 = 165

2,5 / k. V 1,5  
 0,15.

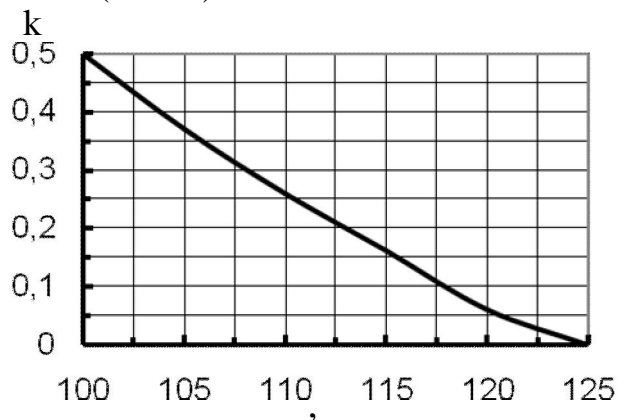
4,5 ( . 6).

(3), f<sub>24</sub> -  
 k.

( )  
 = 100  
 k = 0,5,  
 ( . 7).



. 6.



. 7.

« » ,

(5), k

n = 0.

f<sub>24</sub> 0.

$$_{12} = (k_a + k - F_a - F) / V_o = 0,$$

$$k_a + k - F_a - F = 0.$$

(6)

(6)

125

- 170

«2+4»,

2,5 /

0,001.

( )

3

-160.

-2-35,

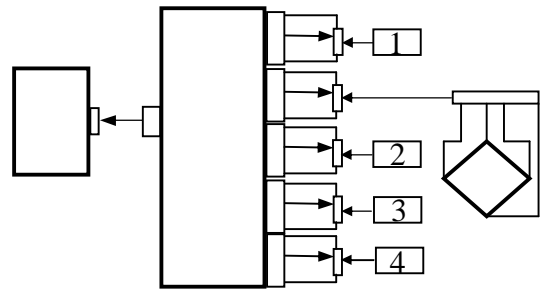
-5-35 ( . 8 )

-4-35 ( «2+4»).

-5-35 ( «0+4»);

-160

-2-35



.8. ( ) - ( ):  
 - ; - ; 1 -  
 -52; 3 - ( ) ; 2 -  
 ; 4 -

«push-pull»

-160.

( )

-160.

( 0,8 ).

[ (ω)]

[ (ω)]

-160,

$$(\omega) = (\sigma / \sigma) \cdot \overline{S_y / S_x},$$

σ , S<sub>y</sub> -

; σ , S -

; ω -

8%,

0,5%,

1%.

5%.

4

«2+4»

$$\frac{69,16}{2} / - 0...1,0^{-1}$$

$$0...0,16 \cdot 0...0,50^{-1}$$

11 .

$$(\omega = 0,50^{-1})$$

$$(\omega = 0,25^{-1}).$$

-160

$$2,96 \cdot (\varphi)^2,$$

1,41

(φ)

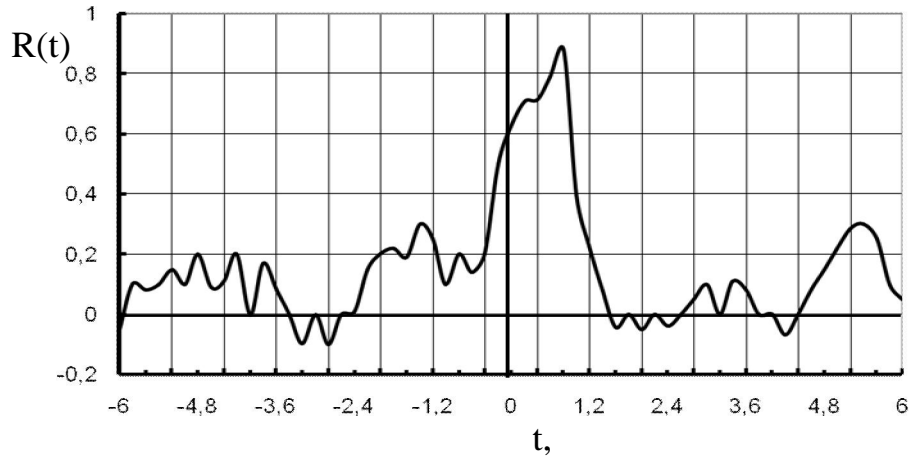
φ

α.



( . 9),

0,88.



. 9.

-160

0,8

-160

-160

9

7

( 1),

«2+4»

«0+5»

20,8%.

16,5%

4%.

( )

	«2+4»		«0+5»
	:	-160	
	-2-35+	-4-35	-5-35
:			
- ,	2,15		1,78
- , / .	7,2		7,5
- ,	25		25
, / ∴			
-	1,55		1,33
-	1,33		1,13
-	1,30		1,10
, /	14,4		16,4
- :			
-	0,86		0,85
-	0,84		0,83
-	0,99		0,99
-	0,90		0,93
:			
- ,	25,7		26,0
- , ±	1,65		1,98
- , ±	6,8		6,3
-			

()

12,2%.

«2+4»,

-160.

95%

5

-160

-5-35

: - 10,8%; - 14,7%; - 17,0%; -  
- 15,8%.  
2,5%

( · ./ ) 10,7% .  
19,8 .

1. ,  
-

2. ,

(α) (β). ( ) -

$\alpha < \beta$   
:  $0 \leq \alpha < \beta; 0 < \beta \leq 8$  .

3. ,  
 $\alpha < \beta$   
(h) ,  $\alpha > \beta$ , (h)  
h h ,

4. ,  
-

» (4)).

5. «2+4» ,  
-

125 , - 170  
2,5 / .  
0,001, ,  
-

6. -160 ,  
 («0+5») -  
 («2+4») -  
 16,5% 12,2%. -  
 «2+4» 10,7% .  
 7. «2+4» , -  
 , ,  
 69,16<sup>2</sup>, -  
 0...1,0<sup>-1</sup> 0...0,50<sup>-1</sup> , 2,0 / -  
 0...0,16 .  
 - , -  
 0,88. ,  
 8. «2+4» ,  
 95% ,  
 (± 1,65<sup>2</sup>) ±1,98<sup>2</sup> ,  
 9. «2+4», -  
 -160 -5-35 :  
 - 14,7%;  
 - 17,0%;  
 - 10,8%;  
 - 15,8%.  
 19,8 .

1. . .  
 / . . // -  
 . - , 2013. - . 15, . 2. . 157-166.

2. . .  
 / . . , . . // -  
 . - , 2013. - . 3, . 1. - . 3-10  
 ( ) -

3. . .  
 / . . // -  
 . - , 2014. - . 4, . 2. - . 168-173.

4. . . «push-  
 pull» / . . , . . // «

», 2015. 2 (101).

.273-280 (

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5.

/ . . . , . . . //

, 2016. – .254. – .271-

278 (

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6.

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( ), 2016, 5 (117). – .2-6 ( ).

«push-pull» / . . . , . . .

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(2016.01) 01 28.09.2015;

77/00 / . . . . 25.04.2016,

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.4, . 2, 2015. . 30-31.

9.

«push-pull» / . . . // «

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05.05.11 –

, 2017.

«push-pull» (« - »)

«push-pull»

-160.

, «push-pull» (« - »),

05.05.11 -

, 2017.

«push-pull» ( . . «

»),

-160.

( $\alpha$ )

( $\beta$ ).

:  $0 \leq \alpha < \beta$ ;  $0 < \beta \leq 8$  .

«2+4»

125

- 170

2,5 / .

16,5%,

12,2%.

«2+4»

(0...0,50<sup>-1</sup>).  
0...0,16 .

2,0 /

) – 0,88. «2+4» ±1,65<sup>2</sup>,  
 (±1,98<sup>2</sup>). «2+4»,  
 -160 -5-35 :  
 14,7%, – 17,0%, – 10,8%,  
 – 15,8%.  
 19,8 . : , «push-pull» (« - »),  
 , , , , .

#### ANNOTATION

Kistechok O.D. Substantiations of the circuit and parameters of the arable unit with forward and back hinged ploughs. – Manuscript.

The dissertation on reception scientific degrees of Cand. Tech. Sci. behind a specialty 05.05.11 – Machines and means mechanization of agricultural production. Tavria state agrotechnological university, Melitopol, 2017.

In basis of dissertational work the hypothesis is fixed that the increase of coupling weight of tractor due to use of a frontal plough at approximately identical traction - power parameters may provide increase width of capture of the arable unit under the circuit “push - pull” at least for width of one case in comparison with U with only one back hinge the instrument. The increase of coupling weight of a tractor, in turn, should to result in reduction of slipping wheels and specific expenses of fuel.

The scientific hypothesis is confirmed with results theoretical and experimental researches traction - power, coursing (in horizontal and longitudinal-vertical planes) and exploitation - technological parameters arable U on the basis of tractor KH Z -160.

Key words: a frontal plough, ”push-pull”, forward hinged mechanism, additional load, coupling weight, deepen moment.

24.01.2017 . : 27. 60 84 1/16.  
0,9 . . 100 .

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