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FEATURES OF THE PROCESS TO INCREASE THE SERVICE LIFE OF THE TURBINE BLADES OF AVIATION ENGINE ON THE BASIS OF FUNCTIONAL-ORIENTED TECHNOLOGY

In this work the analysis of the damage of turbine blades for aircraft engines and existing operating functions, studied the causal relationship of these processes and a classification of the main operational impacts. The proposed schemes orientation of technological influences to increase the service life of the turbine blades of aviation engine on the basis of functionally-oriented technologies.

Keywords: *the turbine blade of aircraft engine, operating exposure, recurrent sequence, uneven wear, the principle orientation of technological impact*

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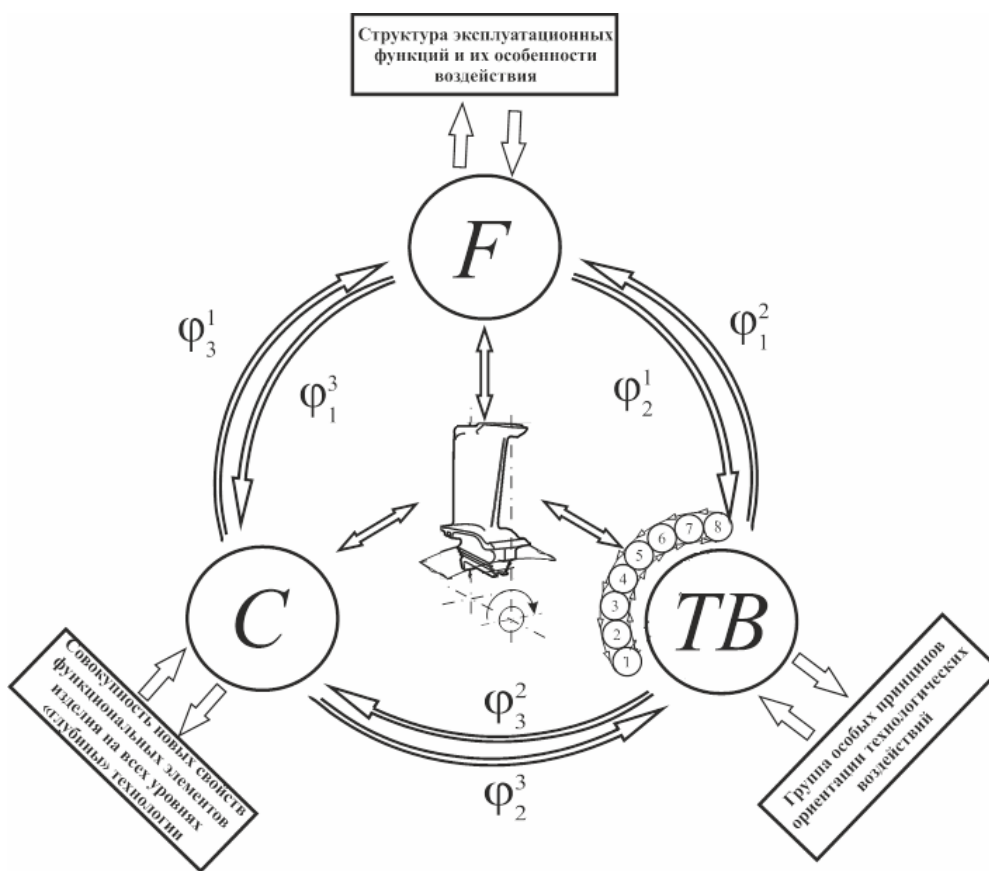
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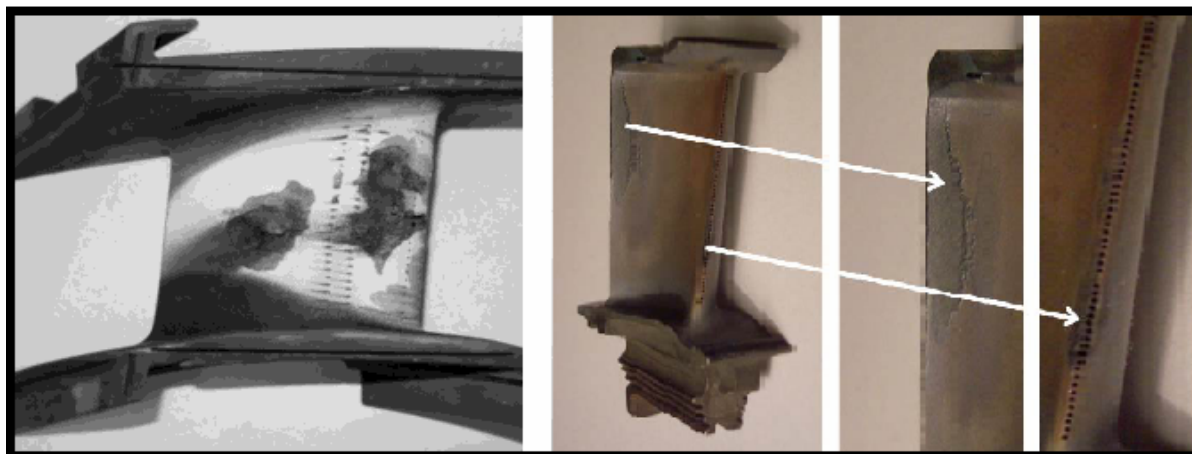
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$$TB \rightarrow \{M, E, I\} = \{(m_1, e_1, i_1), (m_2, e_2, i_2), \dots, (m_G, e_G, i_G)\}, \quad (1)$$

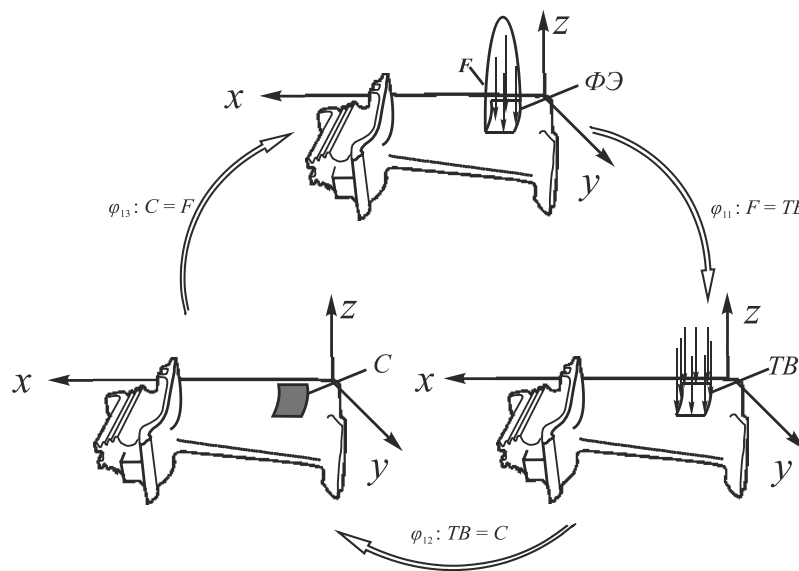
(m_g, e_g, i_g) ; m_g ; e_g ; i_g ; g -

G-

$(m_{s,t,v}, e_{s,t,v}, i_{s,t,v})$.

$m_{s,t,v}, e_{s,t,v}, i_{s,t,v}$

[10].



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$$\left. \begin{aligned} \varphi_{11} : F &\rightarrow TB; \\ \varphi_{12} : TB &\rightarrow C; \\ \varphi_{13} : C &\rightarrow F, \end{aligned} \right\} \quad (2)$$

11 -

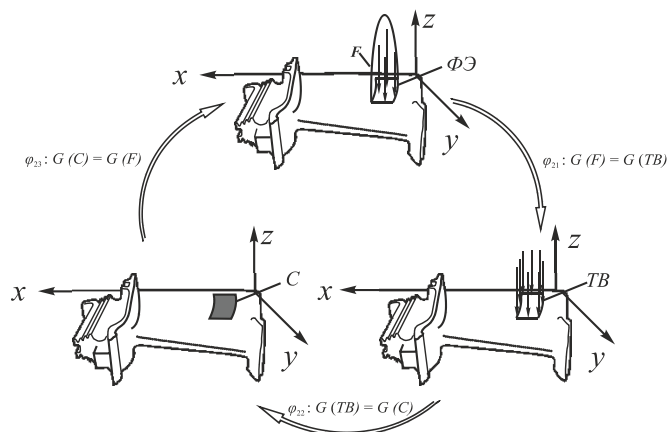
, 12 -

, 13 -

$$TB^{\text{III}} \rightarrow \{(m_{x,y}, e_{x,y}, i_{x,y}), (dl_x \times dl_y)\}, \quad (3)$$

$TB - (m_{x,y}, e_{x,y}, i_{x,y}) -$

$(dl_x \times dl_y) -$



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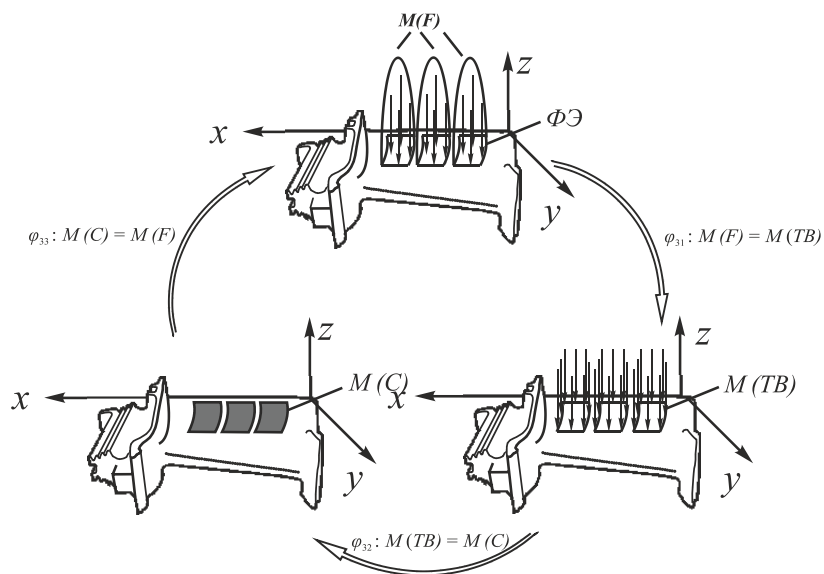
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21 -

$G(TB)$

; 22 -



6 -

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, (F) -

$dC(x,y,z)$, $dF(x,y,z)$, $dTB(x,y,z)$, $dC(x,y,z)$; 43 -

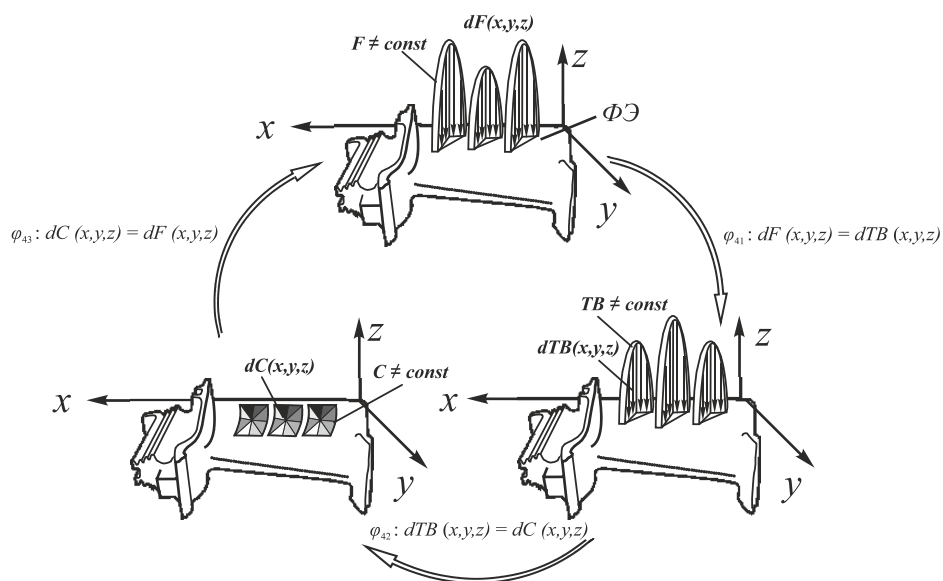
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$$\left. \begin{aligned} \varphi_{41} : dF(x,y,z) \rightarrow dTB(x,y,z); \\ \varphi_{42} : dTB(x,y,z) \rightarrow dC(x,y,z); \\ \varphi_{43} : dC(x,y,z) \rightarrow dF(x,y,z), \end{aligned} \right\} \quad (6)$$

41 -
42 -
43 -

$dF(x,y,z)$, $dTB(x,y,z)$;
 $dTB(x,y,z)$, $dC(x,y,z)$;
 $dC(x,y,z)$, $dF(x,y,z)$.



7 -
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F const,

C const.

$$\left. \begin{aligned} \varphi_{41} : \int_V dF(x,y,z) &\rightarrow \int_V dTB(x,y,z); \\ \varphi_{42} : \int_V dTB(x,y,z) &\rightarrow \int_V dC(x,y,z); \\ \varphi_{43} : \int_V dC(x,y,z) &\rightarrow \int_V dF(x,y,z). \end{aligned} \right\} \quad (7)$$

V-

$$\left. \begin{aligned} \varphi_{511} : dF(t) &\rightarrow dTB(x,y,z); \\ \varphi_{521} : dTB(x,y,z) &\rightarrow dC(t); \\ \varphi_{531} : dC(t) &\rightarrow dF(t), \end{aligned} \right\} \quad \left. \begin{aligned} \varphi_{512} : dF(t) &\rightarrow dTB(t); \\ \varphi_{522} : dTB(t) &\rightarrow dC(t); \\ \varphi_{532} : dC(t) &\rightarrow dF(t), \end{aligned} \right\} \quad (8)$$

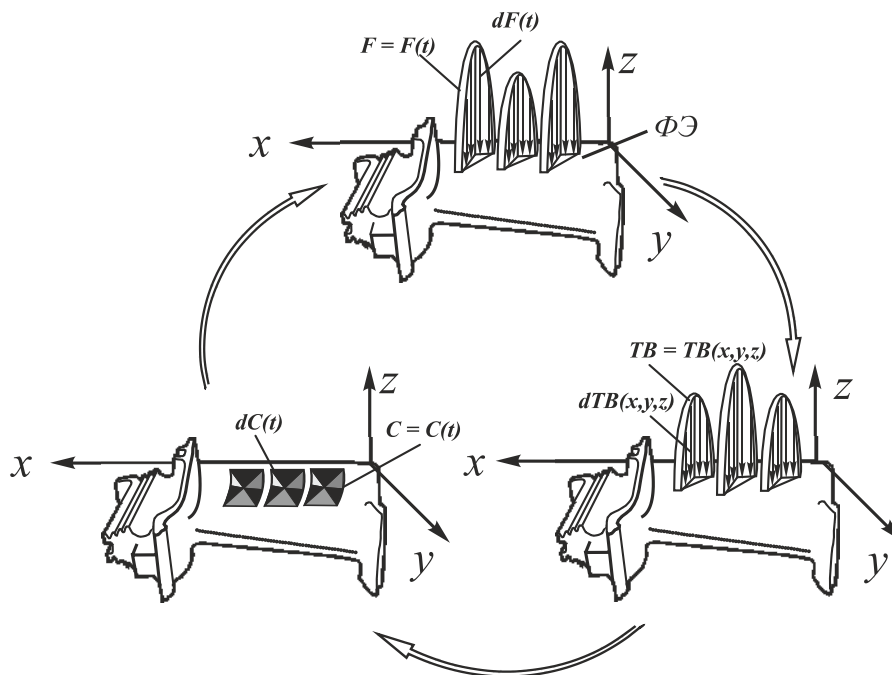
511 -
521 -

$dF(t)$
 $dTB(x,y,z)$

$dTB(x,y,z);$
 $dC(t);$

531 -
512 -
522 -
532 -

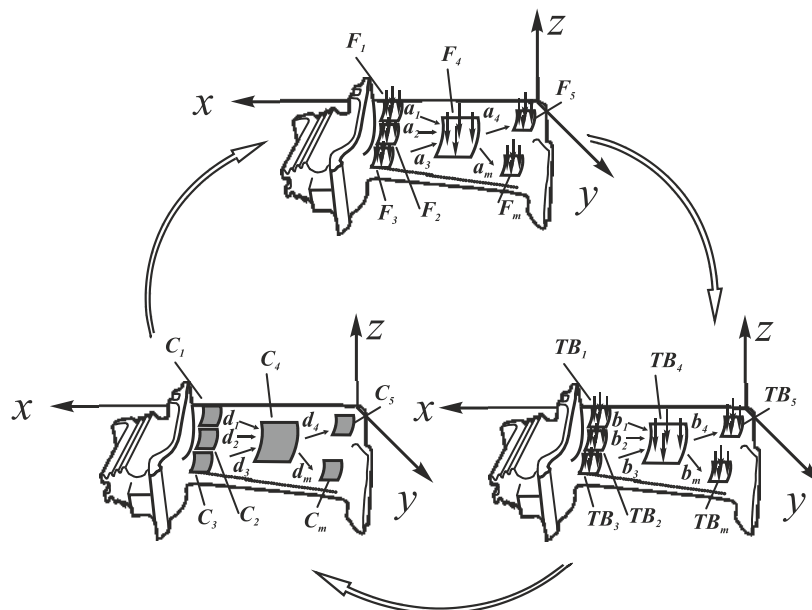
$dC(t)$ $dF(t)$;
 $dF(t)$ $dTB(t)$;
 $dTB(t)$ $dC(t)$;
 $dC(t)$ $dF(t)$;



8 -
 $TB = TB(x, y, z)$ -
 $F = F(t)$ $C = C$
(t) .
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$$\left. \begin{aligned} \varphi_{61} &: Str \{F, A\} \rightarrow Str \{F, B\}; \\ \varphi_{62} &: Str \{F, B\} \rightarrow Str \{C, D\}; \\ \varphi_{63} &: Str \{C, D\} \rightarrow Str \{F, A\}, \end{aligned} \right\}$$

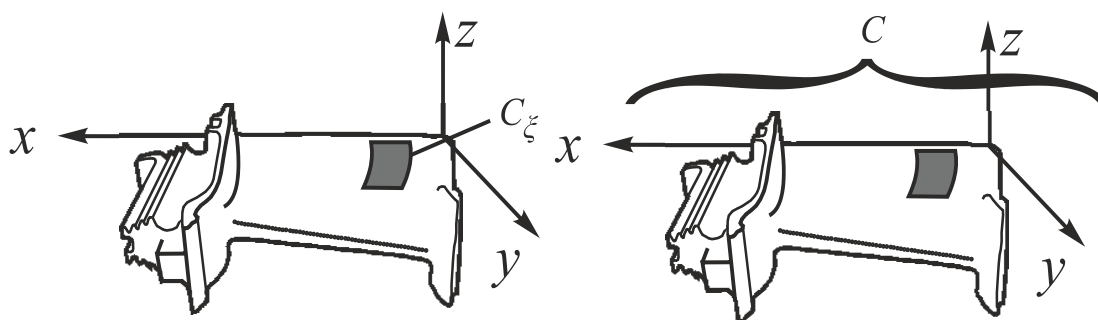
61 - $F = \{F_1, F_2, \dots, F_m\}$ -
 $A = \{a_1, a_2, \dots, a_n\}$ =
= { 1, 2, ..., m } = { b_1, b_2, \dots, b_n }; = { 1, 2, ..., m }
62 - = { b_1, b_2, \dots, b_n } = { 1, 2, ..., m }
 $D = \{d_1, d_2, \dots, d_n\}$ = { 1, 2, ..., m }
63 - = { 1, 2, ..., m }
 $D = \{d_1, d_2, \dots, d_n\}$ $F = \{F_1, F_2, \dots, F_m\}$
 $A = \{a_1, a_2, \dots, a_n\}$



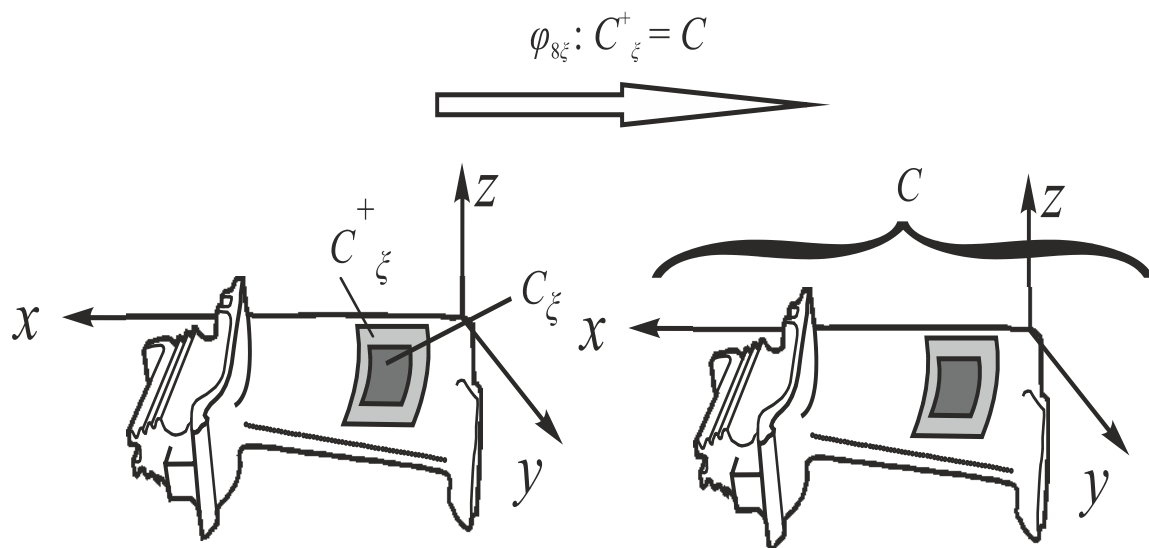
9 -

$F = \{F_1, F_2, \dots, F_m\}, A = \{a_1, a_2, \dots, a_m\}, D = \{d_1, d_2, \dots, d_m\},$
 $C = \{C_1, C_2, \dots, C_m\}, TB = \{TB_1, TB_2, \dots, TB_m\}, B = \{b_1, b_2, \dots, b_m\}$

$$\varphi_{7\xi}: C_\xi = C$$



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XVIII - « -
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5. , . . . // « -
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».- : , 2014. - . 10.
6. , . . . / . . . , . . . // -
« . . . ». 2012. 1. - : , 2012. - . 5 - 14.
7. , . . . -
/ . . . , - :
- ., 2001 - 155 .
8. [/ . . .] / . . . , . . . , . . . -
, . . . , . . . // . - 2015. - 1. -
117-124. - : http://nbuv.gov.ua/UJRN/vvtt_2015_1_20
9. , . . . 1.
/ . . . // - : , 2004. - . 74.
10. . . . / . . . , . . . , . . . , . . .
// - : , 2015. - . 13.
11. <http://ut-market.ru/77-.html>
12. , . . . - / . . .
, . . . // : -
. - : , 2016. - . 2(53). - . 59-75.

15.03.2017 .