THE COMPARED DYNAMIC STUDY OF A NORMAL PARALLEL LATHE FRAME MADE IN THE WELDED VERSION AND CASTED VERSION

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Abstract: In this study we were trying to compare the behavior of cast and welded parallel lathe frame works to dynamic excitation frequencies by calculating depreciation and their own frameworks causing damping capacity with mathematical calculations and practical measurements in lathes with welded and casted frame with horizontal and vertical impulse.

Key words: Comparison, lathe, frame works, structure, cast, welded.

1. THEORETICAL CONSIDERATIONS.

If vibrate unmaintained free dynamic balance equation (1) vibrate movement is of the form:

$$m\ddot{x} + c\dot{z} + kx = 0 \tag{1}$$

where: m - mass; c - damping coefficient; k - spring constant; f – acceleration; $\ddot{x}$ - displacement; $\dot{z}$ -speed.

King m and noting (2):

$$\frac{c}{m} = \lambda \text{ and } \frac{k}{m} = p^2 \tag{2}$$

we get (3):

$$\ddot{x} + \lambda\dot{z} + p^2 x = 0 \tag{3}$$

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where p - pulsation of the system (4):

$$p = 2\pi f_m \frac{2\sqrt{c}}{T} \tag{4}$$

where: f - frequency oscillation; T - period oscillation.

Differential equation solving this equation yields solutions that provide information about the movement of the structure (characteristic points)

Amplification baseline vibration (5) is:

$$x_1 = x_0 e^{-\lambda_t} \tag{5}$$

T vibration amplitude after time, until the touch (6) is:

$$x_2 = x_0 e^{-\lambda_T} \tag{6}$$

The intensity of depreciation is given by the ratio of two successive amplitudes (7):

$$\frac{x_1}{x_2} = e^{\lambda_T} \tag{7}$$

The natural logarithm of the report is called logarithmic decrement damping (8):

$$\delta = ln \frac{x_1}{x_2} = \lambda_T \tag{8}$$

Calculation results in finding δ logarithmic decrement damping factor λ (9):

$$\lambda = \frac{\delta}{T} \tag{9}$$

2. EXPERIMENTAL CONDITIONS.

Lathes are with welded frame and casted under the same conditions of settlement in the foundation. That means that a rubber hammer was applied in order to generate signal pulse on the bed frame structure in the headstock and the movable doll. The pulses were applied both vertically and horizontally. Impulse response frameworks were collected through an interpreter seismic and recorded. For each level and place of application of impulse response was picking both vertically and horizontally. In the form of registered pulse was obtained vibration amplitude, the oscillation period and the amortization period.

With these parameters were obtained intensity depreciation δ, λ and pulsation damping response p. Means RPT vibrometer measuring transducer KD 34.

3. CONCLUSIONS

Besides headstock arousal and response. Welded to the frame of the vertical frequency of the impulse response is 40 Hz, the period of 150 ms damping being greater in vertical direction than in the horizontal direction 35 ms. To the framework poured vertical impulse frequency response is 20 Hz, the amortization period is approximately the same in horizontal and vertical direction. Comparing welded frameworks and poured observed that the cast machine frame has a damping factor better than λ cast machine frame.

The momentum in the horizontal direction on the bedframe environment shows that its response takes place on other frequencies and payback lower than the vertical impulse.

Coming from factors observed as a warning to the framework coefficient λ better than the molten weld. Arousal and response next of tailstock.

The frequency response of frameworks with excitement next of the tailstock have the same values as the next of the headstock excitement under the same excitement and response.

To the framework poured appear higher frequency response (own bed frame and no settlement construction) which do not appear welded to the framework.
Comparing the damping factors λ there is a better damping of the bed frame welded.

The values of besides excitement tailstock are in table 1.

Table 1. **Besides excitement tailstock**

Parameters	**Vertical impulse Vertical reaction (Figure 1)**		**Horizontal impulse Vertical reaction (Figure 2)**		**Vertical impulse Horizontal reaction (Figure 3)**		**Horizontal impulse Horizontal reaction (Figure 4)**	
	B.S.	**B.T.**	**B.S.**	**B.T.**	**B.S.**	**B.T.**	**B.S.**	**B.T.**
T_1 **(ms)**	150	175	35	120	35	110	56	80
T_2 **(ms)**	25	50	18	50	25	50	18	50
f_1 **(Hz)**	7	6	29	8	29	9	20	12
f_2 **(Hz)**	40	20	56	40	40	20	56	20
p_1 **(rad/s)**	44	38	182	50	182	57	126	75
p_2**(rad/s)**	251	126	352	251	251	126	352	126
$\bar{x}_i$	2	2,2	1,0	1,2	1,1	1,2	1,4	1,2
x_i**+1**	1,6	1,5	0,7	0,9	0,5	1,0	1,2	0,5
δ	0,2	0,3	0,4	0,3	0,8	0,3	1,5	0,9
$\lambda*10^{-3}$	1,4	1,7	11,4	2,5	22,8	2,8	26,7	11,2

The graphic value of besides excitement tailstock are in figures 1, 2, 3 and 4.

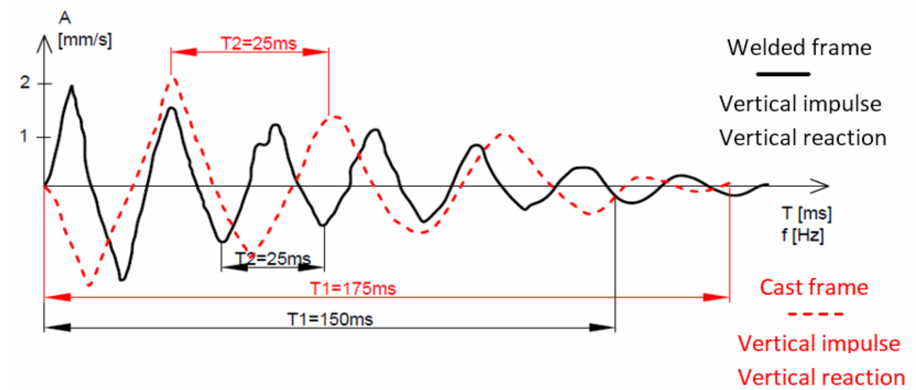

Fig. 1. Vertical impulse and vertical reaction

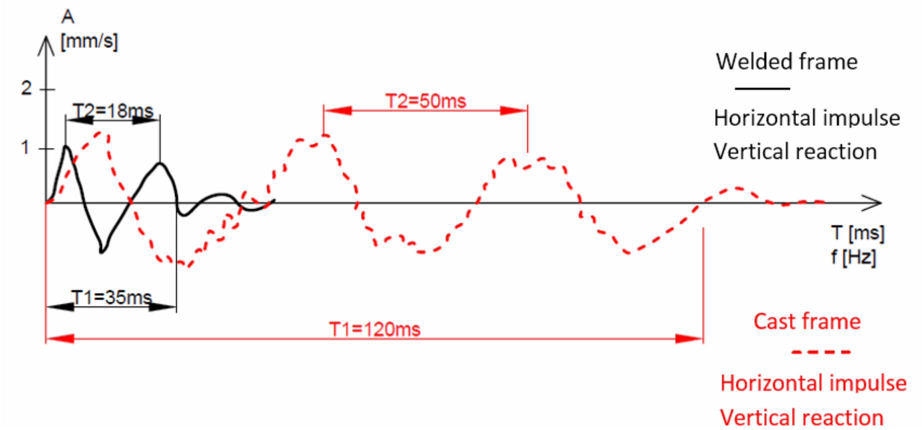

Fig. 2. Horizontal impulse and vertical reaction

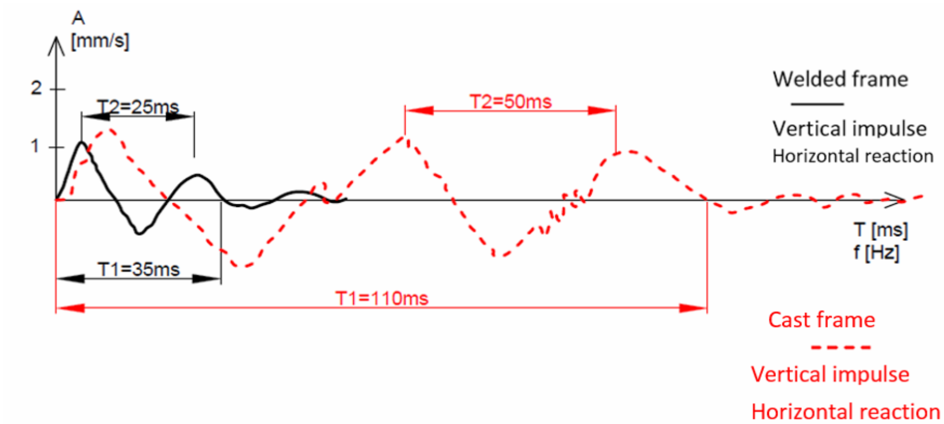

Fig. 3. Vertical impulse and horizontal reaction

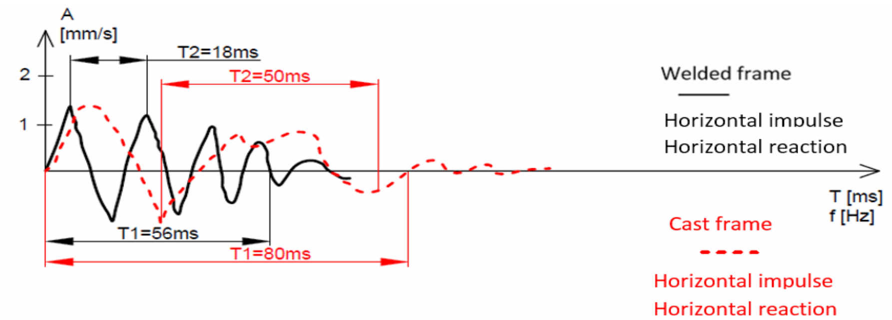

Fig. 4. Horizontal impulse and horizontal reaction

The value of besides excitement headstock are in table 2.

Table 2. **Besides excitement headstock**

Parameters	**Vertical impulse Vertical reaction (Figure 5)**		**Horizontal impulse Vertical reaction (Figure 6)**		**Vertical impulse Horizontal reaction (Figure 7)**		**Horizontal impulse Horizontal reaction (Figure 8)**	
	B.S.	**B.T.**	**B.S.**	**B.T.**	**B.S.**	**B.T.**	**B.S.**	**B.T.**
T_1 **(ms)**	150	130	35	50	35	120	65	80
T_2 **(ms)**	25	50	18	20	25	50	18	20
f_1 **(Hz)**	7	8	29	20	20	8	15	20
f_2 **(Hz)**	40	20	56	50	40	20	56	50
p_1 **(rad/s)**	44	50	182	126	182	50	94	75
p_2**(rad/s)**	251	126	352	314	251	126	352	314
$\overline{x}_i$	1,6	1,3	1,2	0,9	1,1	1,1	1,1	1,1
x_i**+1**	1,1	1,1	0,8	0,6	0,7	0,6	0,8	0,6
δ	0,4	0,2	0,4	0,4	0,5	0,6	0,3	0,3
λ***10**$^{-3}$	2,6	1,5	11,4	8	14,3	5	4,6	3,7

The graphic value of besides excitement headstock are in figures 5, 6, 7 and 8.

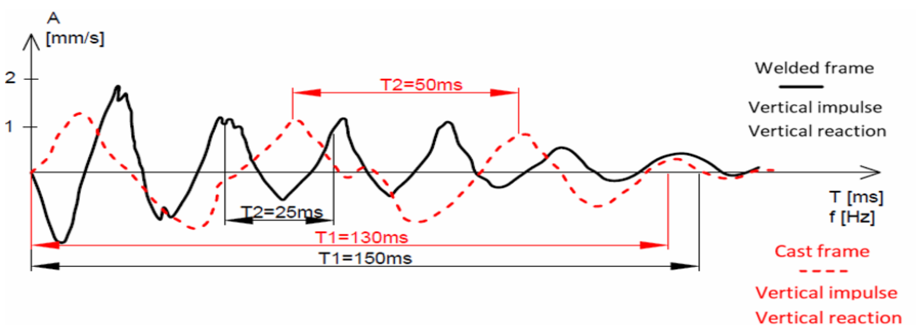

Fig. 5. Vertical impulse and vertical reaction

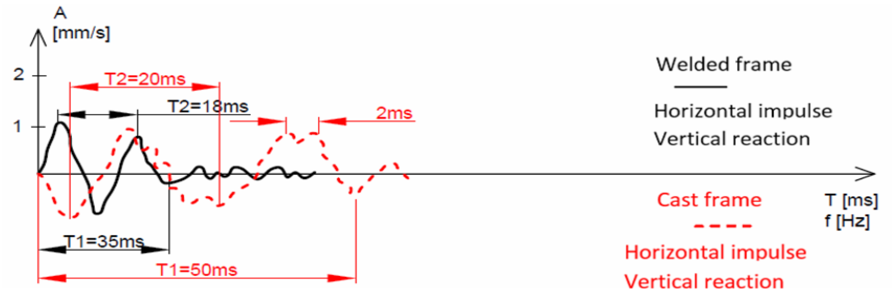

Fig. 6. Horizontal impulse and vertical reaction

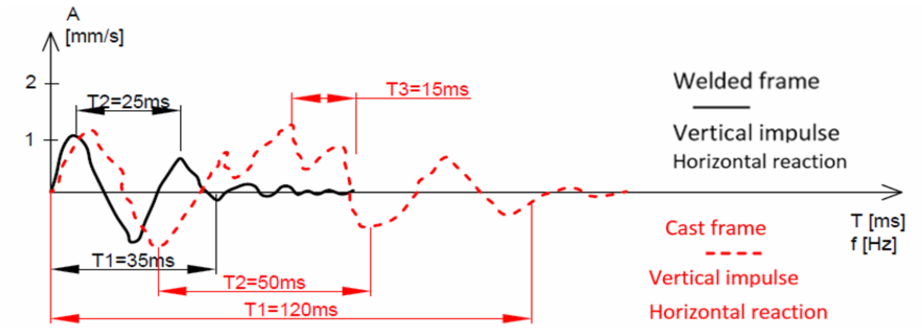

Fig. 7. Vertical impulse and horizontal reaction

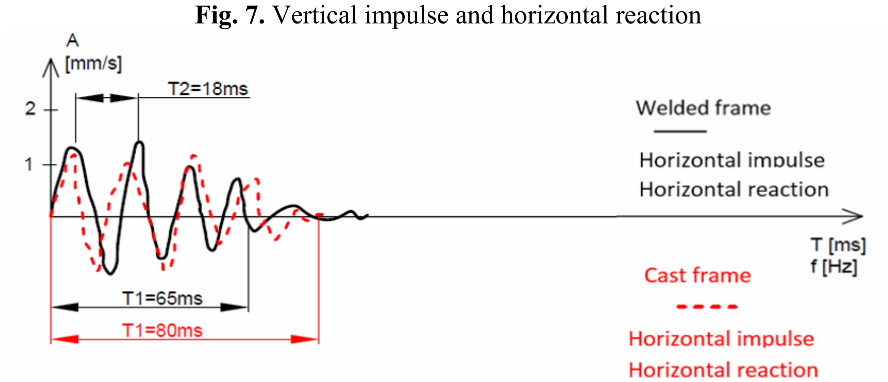

Fig. 8. Horizontal impulse and horizontal reaction

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