Features of Impulse Stabilizer Output Smoothing Filter Parameters Choosing

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Abstract - **Voltage ripple factor dependence at the impulse stabilizer output smoothing filter on the voltage mark-to-space ratio, which controls the key element of the stabilizer is investigated. Expressions, which allow to provide rational selection of the smoothing LC-filter elements and size up the amplitude of the ripple voltage at its output are obtained.**

Keywords – **Impulse stabilizer, smoothing filter, ripple voltage.**

I. INTRODUCTION

Analysis of the smoothing effect to provide optimal output filter elements choosing in the case of up-to-day impulse stabilizers is needed. Ripple voltage does depend on the pulses duration and its influence should be analyzed. Internal inductance of filter oxide capacitors can put changes to the smoothing process too.

II. RIPPLES ANALYSIS

Input voltage spectrum of an impulse stabilizer smoothing filter is determined by a value of mark-to-space ratio of a voltage which controls keying element [1].

Amplitude value of the harmonic components at the impulse regulator input, taken from the expression for the input voltage given as the Fourier series [1,2] is

$$U_{nm} = \frac{2}{\pi \cdot n} U_{BX} \cdot \sin \pi \cdot n \cdot \gamma, \qquad (1)$$

where: U_{BX} - stabilizer input voltage, γ - mark-to-space ratio of pulse voltage, which controls the key element ($\gamma = t_i / T$, t_i - modulation pulse duration, T - modulation pulse period), n - input voltage harmonic component number.

When applying to the filter with smoothing ratio $q = \omega^2 L \cdot C - 1$ ($\omega = 2\pi \cdot f$, where f – switching frequency of the stabilizer keying) mentioned above voltage (given as series), the ripple coefficient at its output, neglecting 1, will be equal

$$K_{\Pi BИX} = \frac{A}{L \cdot C \cdot f^2} \cdot 100[\%], \qquad (2)$$

where

$$A = \frac{\sin \pi \cdot n \cdot \gamma}{2 \cdot \gamma \cdot (\pi \cdot n)^3}.$$

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In practice impulse stabilizers are operating in a regime at which $0,2 < \gamma < 0,8$. As it can be seen from the graphs, output filter ripples at this are conditioned by the first harmonic as second and third harmonic amplitude values are less by the order in the mentioned range of γ changes.

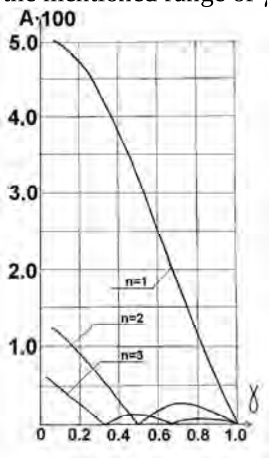

Fig. 1. Dependence of A from the γ coefficient

With the error less than 5% due to the linear change of A for the first harmonic it can be received that A = 0,063 (1 - γ). Substituting it to the (2) we'll receive the expression for smoothing LC-filter parameters choosing at given value of the ripple coefficient at the filter output

$$L \cdot C = \frac{0,063(1-\gamma)}{K_{\Pi BИX} \cdot f^2}. \qquad (3)$$

After the simplest conversions the amplitude value U_{Π} of the ripples at the filter output can be received from $U_{\Pi} = K_{\Pi BИX} \cdot \gamma \cdot U_{BX}$, after substitution formula (2) in it expression for U_{Π} receives the view

$$U_{\Pi} = 0,063 \cdot U_{BX} \cdot \frac{t_i \cdot t_{\Pi}}{L \cdot C}, \qquad (4)$$

where t_{Π} = T - t_i - spacing between the modulation pulses duration.

III. CONCLUSION

Expressions received permit to provide smoothing filter elements rational choosing and ripple voltage amplitude value at its output calculating.

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