Construction of High-Efficient Class D Power Amplifiers

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Abstract - **The amplifiers of class D with pulse with modulation (PWM) which work in the mode of tracing are are analyzed. The transfer functions of closed, combined, two-connected and iterated systems are obtained. Application amplifiers with combined, two-connected, iterated control allow the astatism order of an.**

Keywords - **amplifiers of class D, closed, combined, two-connected and iterated systems, astatism.**

I. INTRODUCTION

Last year's demand for amplifiers class D again has increased, thanking their high efficiency and reachings in solid-state technology.

Design of effective key amplifiers demands not only raises of energetic parameters, decrease of mass-dimensional parameters, slackings of electromagnetic interferences, but also martempering of workers static and dynamic characteristics.

Researches of workers static and dynamic characteristics of amplifiers it is conducted in two directions :

- The amplifier is observed as discrete (pulsing) model [1];
- The amplifier is represented in the form of continuous model [2].

Among operating characteristics the special place is occupied with a static error at reproduction of an arrival signal of the amplifier.

In paper it is offered to deal with a problem of a diminution of a static error of key amplifiers in class-rooms of the combined, two-connected and iterative systems on the basis of the theory of invariancy [3], in particular, a method of raise of an order of astatism [4].

II. THE BASIC PART

Let's observe the amplifier of class D with a control principle on a deviation. Transfer function of the shorted system of the amplifier by mistake

$$K_{mis}(p)=\frac{\theta(p)}{\alpha(p)}=\frac{T_f^2p^2+2\xi T_f p+1}{T_f^2+2\xi T_f p+1+k_a k_m \gamma k_f}= \\ =\frac{a_0p^2+a_1p+a_2}{b_0p^2+b_1p+b_2}=K_{mis\,st}(p)\cdot p^{\nu=0}=K_{mis\,st}(p), \quad (1)$$

where $\alpha(p)$, $\beta(p)$ - Laplace transforms of setting affecting (input signal) and a controlled variable (output signal), k_a, k_m, k_f - transfer ratios of the amplifier, the pulse-width modulator, the hum filter accordingly; γ - a stacking factor; T_f - filter time constant; ξ - damping coefficient, $a_0 = T_f^2$; $a_1 = 2\xi T_f$; $a_2 = 1$; $b_0 = T_f^2$; $b_1 = 2\xi T_f$; $b_2 = 1+k_a k_m \gamma k_f$, ν - extent of astatism,

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$K_{mis\,st}(p)$ - transfer function by mistake of a static system.

From (1) it is visible that the amplifier of class D with a control principle on a deviation is a static system with a zeroth order of astatism.

Raise of an order astatism it is possible to achieve at the expense of a heading of an integral pulse-width modulator (IPWM) in the control diagramme amplifiers of class D

For raise of an order of astatism with first (the shorted model of the amplifier of class D about IPWM) to second (the combined model of the amplifier of class D about IPWM) it is necessary by means of the broken link on setting affecting to inject the first derivative from $\alpha(t)$ [5].

III. CONCLUSION

In the amplifier of class D with a control principle on a deviation, having a zeroth order of astatism, the static error at a step modification of setting affecting is restricted by a finite value, at linear and quadric - tends to infinity.

Introduction of the integral pulse-width modulator (IPWM) in the control diagramme of the shorted amplifier of class D increases an order of astatism to first and by that reduces an order a static error at a step modification of setting affecting to null, at the linear is restricted by a finite value, and at the quadric tends to infinity.

Synthesis of the broken compensation link on setting affecting of the amplifier with the combined control has allowed to lift an order of a servo system type number to second and consequently, the static error at a modification of setting affecting under step and linear laws is equal to null, and at the quadric is restricted by a finite value.

Considerable outcomes of raise of accuracy of key amplifiers of class D should be expected from a heading of the systems combining combined (including two-connected) and iterative structures.

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