

# AN OPTIMIZATION OF HALF-BRIDGE INVERTERS WITH A TRANSFORMER LOAD

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Half-bridge inverters with transformer loads in an alternating current (ac) diagonal are widely used in various electrical installations. Classic variant of such inverters is corresponded the half-bridge of two transistors shunted by two reverse diodes and the half-bridge of two capacitors in-series. A load of the ac diagonal is usually a transformer and the direct current (dc) diagonal is connected to the power source. Main advantages of such inverters are simplicity of the circuit and a default of the constant component in the ac diagonal. The replacement of transistors by thyristors in the half-bridge has own deficiencies: a thyristor half-bridge inverter is operable in restricted load range and his regulation is probable by pulse-frequency method only. Using of the additional switching unit permitting to perform the recharge of the metering capacitor is part of that unit are one of removal variants of that's disadvantages. Thus a half-bridge inverter control is realized over a wide load range by the instrumentality of the standard time-proportional control system closed on a load current. The hardware form of a realization of the described control system is given in [1] and the up-to-date form microcontroller-based is given in [2]. But a range extension of regulation of an inverter load is attended by definite problems: 1) the preliminary recharge circuit of metering capacitor contains the circuit composed of thyristors, inductances and the metering capacitor in-series, that increased additional energy losses; 2) transformer windings voltage amplitude and load voltage were vary from zero to supply voltage when the control process is occurred. When voltage amplitude is reduced that an ionization is complicated and an arc excitation is complicated if, for example, electrical arc was a load [3]; 3) the circuit of the additional switching unit is more difficult.

The solution permitting to eliminate above-listed disadvantages is proposed in [4]. The new respective circuit of the thyristor half-bridge inverter is shown on figure 1.

The device contains the thyristor half-bridge inverter compressed of capacitors 1, 2, thyristors 3, 4, and the additional switching unit. This unit is corresponded the additional thyristor half-bridge inverter compressed of thyristors 7, 8 and capacitors 5, 6 which capacities are far less than capacities of capacitors 1, 2. The dc diagonal of this additional inverter is connected in-parallel with the thyristor half-bridge inverter 1, 2, 3, 4. The primary winding of the transformer 9 is connected with the ac diagonal of the half-bridge inverter 1, 2, 3, 4. And the secondary winding

of this transformer is connected to the direct current load 13, which is connected in-parallel with the current sensor 14. In addition, the transformer 9 contains the additional winding 15 that is connected to the ac diagonal of the additional thyristor half-bridge inverter 5, 6, 7, 8 and having the number of loops are less than the number of loops of the primary winding 10. The control system is corresponded the standard system of a pulse-frequency regulation. This system consists of the surge injector unit 16 connected with the one of outputs of pulse-length modulator 17. In addition, the feedback controller is compressed of standard system of a pulse length regulation and the mentioned standard system is closed on a load current by an output signal of the current sensor 14 connected with one of outputs of the feedback controller 18. The secondary input of this controller is connected with the signal of source current  $U_3$  and the output of this controller 18 is connected with the secondary input of the pulse-length modulator 17. The output of the mentioned surge injector unit 16 is connected with respective driving points of thyristors 3, 4 and the output of the pulse-length modulator is connected with respective driving points of thyristors 7, 8 included in the additional thyristor half-bridge inverter 5, 6, 7, 8.

The new device permits to exclude the circuit of a preliminary recharge of the metering capacitor together the metering capacitor. Capacitors of the thyristor half-bridge inverter are performed the duties of the metering capacitor thus losses were decreased and circuit was more simplify. In addition, voltage amplitude of the load was not changed and was some more than voltage supply when half-period average voltage of the load was changed in the mentioned device. That made considerably easier the "firing" and the arc stability if arc space was a device load.

## References

1. Bulatov O.G. and other. Thyristor-capacitor power supplies for electrical installations. Moscow.: «Energoatomizdat», 1989.
2. Pryashnikov V.A. Electronics. Saint-Petersburg, 1998.
3. «Invertec» - V - 130-S-Lincoln. USA, 1998.
4. Magazinnik L.T., Magazinnik A.G. The half-bridge thyristor inverter. Patent RU 2321942 10.04.2008.

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### THE POWER EFFICIENCY RISE OF HEAT TECHNOLOGICAL SCHEME OF THE ETHYLENE PRODUCTION

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The ethylene production is the large consumer of the fuel and energy resources that is conditioned by the considerable fuel and energy consumptions at the multi – staged hydrocarbon raw materials processing. The system organization of the complex utilization of the repeated energy resources (RER) is the perspective direction of the fuel and energy cost cutting in the considered production.

The heat technological scheme of the ethylene production is included in itself several thousands elements of the polytypic equipment. To estimate the work efficiency of such complex system and to reveal the organization version of the RER utilization system are suggested on the basis of the system analysis, having included the structure analysis of the internal and external connections of the considered object, and also the thermal and thermodynamic efficiency analysis. Its calculated model has been obtained, as a result of the system analysis carrying out, in particular, in the issue of the dependences exposure between the scheme's elements, the separation of the elements' open – ended and closed sequences of the considered scheme. The thermodynamic efficiency analysis of the heat technological scheme has been conducted, that permitted to estimate the rate of the system thermodynamic perfection, to expose the losses from the irreversibility, to make the estimate of the elements efficiency in the system composition, to determine the technically well – behaved energy value, to estimate the energy conservation reserves.

The circuit solutions on the organization of the RER utilization system have been suggested, having provided the technological production and the energy resources working out in a view of the steam, hot water and cold of the required parameters on the basis of the steam – jet compressors and the absorptive refrigerating machines use.

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### PROBLEMS OF THIRD-GENERATION STATE EDUCATIONAL STANDARDS IN HIGHER PROFESSIONAL EDUCATION FOR QUALIFICATION “EQUIPMENT AND INSTRUMENTS IN CHEMICAL INDUSTRIES”

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Third-generation state educational standards in higher professional education (SES HPE) are aimed at forming a regulatory system for a better quality of the Russian education in the nearest future. A Ministry, responsible for developing this regulatory system of state educational standards, think, that the main distinctions of the SES HPE will be the following:

- strong competent character of the standards;
- development of standards for different professions. The corresponding degree is received after completing a bachelor, specialist or master educational program, which are united by a common fundamental basis;
- well-grounded requirements to learning results in the main educational programs (educational results) in form of competencies, divided into general (broad-based) and professional (subject disciplines);
- absence of component structure (federal, regional, institutional), and at the same time significant enlargement of academic freedom for higher educational institutions in questions of basic educational program development;
- establish new ways of labor intensity calculation in form of credit points instead of hours.

So, the third-generation SES HPE, according to the Ministry, will become a federal quality standard system for higher education. The norms should minimize their contradictory interpretation in the Russian regions and universities. Besides, these standards should simplify integration of the Russian educational system into the European one, and help the university graduates find employment in every country, that signed the Bologna Declaration.

So far, the Russian Ministry of Education and Science has not yet developed a clear strategy regarding deadlines and stages of transition to the new SES HPE; number of professions; differences between specialized secondary qualifications and university degrees; number of graduates with a specialized secondary qualification and university graduates in the labor market. But, without having solved all these questions, the Ministry has issued a decree that, starting from 2009, introduces a two-level degree structure - bachelor and master.

Such a tearing hurry in a serious matter of transition to new educational standards is absolutely incomprehensible. According to the «List of professions» on the official website of the Russian Ministry of Education and Science, there is practically no