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# Ferroelectric Transformer

By F. F. Mende

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# Ferroelectric Transformer

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## I. Introduction

In connection with the fact that the law of magneto electric and electromagnetic induction, recorded in the total derivatives [1], they are symmetrical:

$$\oint \vec{E}' d\ \vec{l}' = -\int \frac{\partial \vec{B}}{\partial t} d\ S - \oint [\vec{B} \times \vec{V}] d\ \vec{l}'$$

$$\oint \vec{H}' d\ \vec{l}' = \int \frac{\partial \vec{D}}{\partial t} d\ S + \oint [\vec{D} \times \vec{V}] d\ \vec{l}' \quad ,$$

therefore must exist and the symmetrical technical solutions. Such solutions are located. For example, with the aid of the revolving magnetic field it is possible to create electric motors. For the same purposes it is possible to use the revolving electric field, and the engines, which use this principle, exist. There exists the transformers c ferromagnetic [serdechnikkom], in which with the aid of the magnetic flux they transfer energy of one winding into another. The symmetry of the laws indicated tells us, that must exist the transformer, whose core will be executed not of the ferromagnetic material, but of the ferroelectric. In the technology the transformers with the ferromagnetic cores widely are used. Their incapacity to work at the high frequencies is a large drawback in such transformers.

Is connected this with the large inertness of the processes of the reversal of polarity of transformer core. And in this connection question arises, and is it possible to create the transformer, in which as the core is used not the ferromagnetic material, but ferroelectric. Since the processes of electrical polarization have very small inertia, this transformer could work at the very high frequencies.

## II. Possible the Schematics of Transformer

Let us examine the possible the schematics of ferroelectric transformer [2, 3].

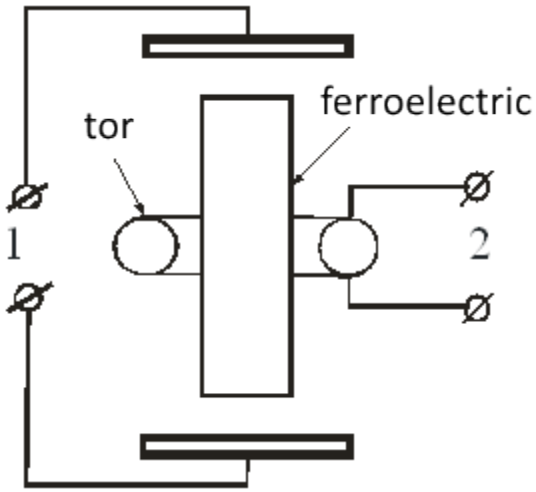


*Fig. 1:* Schematic of ferroelectric transformer

In to the composition of transformer enters the parallel-plate capacitor, between plates of which is placed the cylinder from the ferroelectric with the large dielectric constant. On the cylinder is placed the winding of torus, whose ends are connected to terminals 2. During the supplying to the capacitor of alternating voltage in the cylinder there will be leak polarization currents and the time-varying circulation of magnetic field will arise around the cylinder. This circulation will excite in the torus-shaped winding currents and a variable potential difference will appear on terminals 2.

Transformer with the toroidal ferroelectric core is depicted in Fig. 2.

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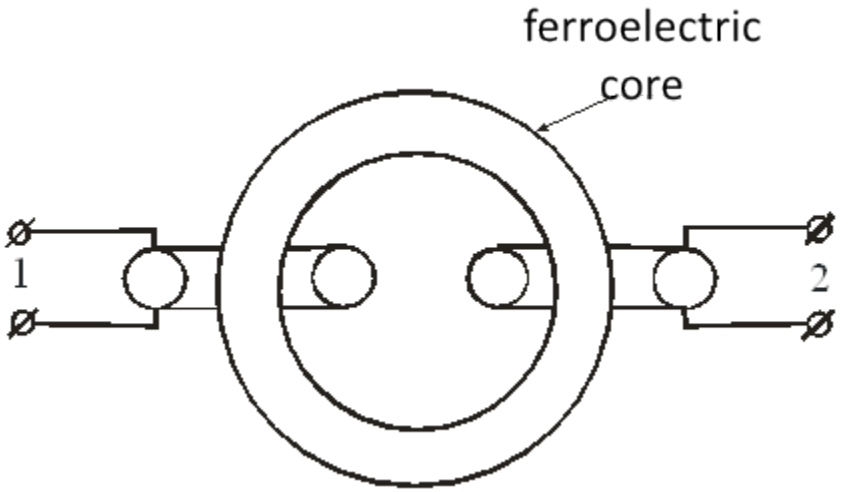


*Fig. 2:* Transformer with the toroidal ferroelectric core

It consists of the torus-shaped core, made from the ferroelectric, on which are placed two torus-shaped windings. The transformation ratio of this transformer depends on the relationship of the number of turns in the windings. The merit of transformer is the fact that it can work at the very high frequencies.

## III. Conclusion

In spite of simplicity of idea and construction, unfortunately, the transformers of this type before the appearance of works [3] is nowhere described. But indeed they open very large prospects. It is known that the magnetic amplifiers, which possess high reliability, cannot find wide application only because they work at the low frequencies. In this case there are no such limitations in practice, since the processes of electrical polarization have very small inertia, and, using the transformer examined, it is possible to create the reliable wideband amplifiers, which work at the very high frequencies.

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