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EDDY CURRENTS - MAIN CHARACTERISTICS, ADVANTAGES AND DISADVANTAGES

Eddy currents (also called Foucault currents) are electric current loops that are induced inside the conductors by changing the magnetic field in the conductor according to the Faraday Law of induction. Eddy currents flow in closed loops inside the conductors, in planes perpendicular to the magnetic field. In such case, not the field itself can change, but the position of the conductor in this field, that is, if the conductor starts to move in a static field, then Foucault currents will still form in it. The trajectory of such currents cannot be determined. It is only known that the current flows in the place where the resistance is minimal.

Closed cyclic currents can be formed in a conductor only if the magnetic field in which the conductor is located has an unstable structure. From this it follows that the force of the eddy currents has a direct relationship with the rate of change of the magnetic flux passing through the conductor. According to the generally accepted theory, electrons move linearly in the conductor due to the potential difference, which means that the current has a direct direction. Foucault currents behave in a completely different way and form a vortex closed circuit directly in the conductor. Moreover, these currents are capable to interact with the magnetic field, which created them. That is, the conclusion is that the magnetic

field generated by eddy currents does not allow the magnetic flux that created these currents to change.

In the transformer, the core is assembled from separate plates. With this “fragmentation”, they try to minimize the negative influence of the Foucault currents, which heat the core. Heating leads to reduced efficiency, and severe overheating leads to melting of the insulation and destruction of the transformer.

That is why, the core is assembled from thin plates, isolated from each other by a layer of varnish or other insulating material. This method of core assembly minimizes core losses, that is, reduce eddy currents to a minimum.

These currents carry not only negative effects. They have long learned to use it for the benefit of our lives. For example, the properties of eddy currents are used in induction meters. These currents slow down the rotation of the aluminum disk, which rotates under the influence of a magnetic field. Also, the creation of induction steel-making furnaces has made an incomparable contribution to the development of the entire modern steel industry. Such furnaces work as follows: the metal to be melted is placed inside the coil, through which an increased frequency current begins to pass.

The same interactions helped to realize the idea of creating a pump for pumping molten metals. Foucault currents cause the appearance of a skin effect. As a result of their action, the efficiency of the conductor decreases, since the actual current is absent in the center of the conductor cross section, but prevails at its periphery.

To reduce energy losses, especially when transmitting over long distances, a multi-channel cable is adopted, each core in which has its own insulation. Eddy currents, namely induction furnaces designed on their basis, are widely used in metallurgy. Even in everyday life, we use induction stove, the principle of which is also based on the use of the effect of the formation of eddy currents.