Inductive transmission systems

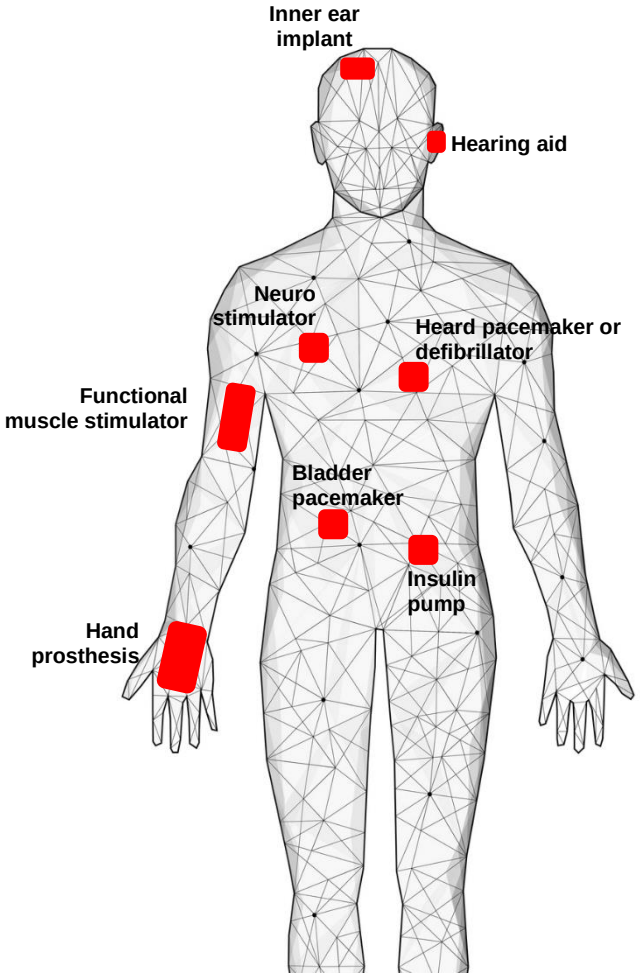
Technical background

In the widest range of applications in our daily lives, electrical energy is transmitted from a source or power supply to a load or device. Systems that work on a contactless basis are increasingly being used for this. The resulting technical and commercial benefits expand the range of application to include lots of new applications, in which moveable units and encapsulated systems are used. See below for some examples of use:

Active implants in the field of medical technology

In medical operations, electronic components are increasingly being implanted, such as for example dispensing valves or so-called shunt valves. To protect the patient against infection, these are inserted completely under the patient's skin. There is no direct electrical connection. To supply such implants with power, electromagnetic transmission systems are used instead. As well as supplying the implant with power, they also enable data transmission, to facilitate configuration and programming, for diagnosis purposes and for monitoring functioning.

Specially adapted transmission units reduce the patient's exposure to electromagnetic waves, minimize the size of such systems to the necessary and cut down material usage to the essentials.



Examples of active implants

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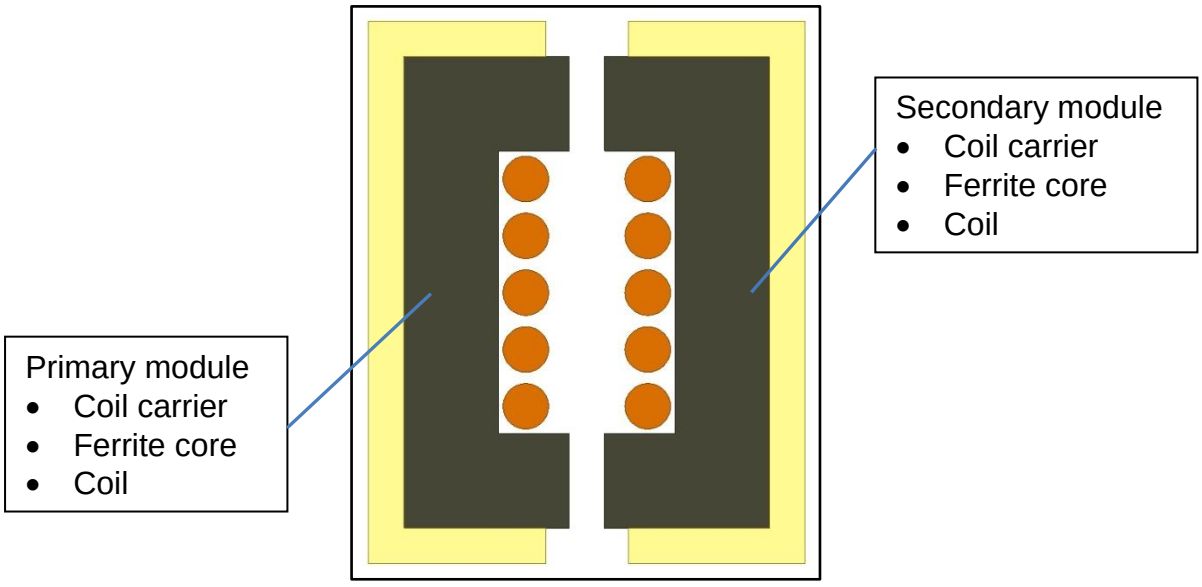
Rotating systems in the field of automation technology

In the field of industrial automation technology, manual and robot-controlled production processes are increasingly merging. The resulting systems are known as collaborative systems. In order to monitor such production areas in respect of safety-related and functional considerations, sensor systems containing rotating scanning sensors are increasingly being used. Some examples are 360° laser and radar scanners. A rotating scanning system forms the core of such sensors. In previous generations, such scanners were equipped with sliding contacts, in order to establish power and signal transmission between the stator and the rotor. These electromechanical contact elements have significant disadvantages, such as wear, noise emission and the effort required for installation, whereby their service life is considerably reduced. In advanced, modern equipment, this unit is replaced by an electromagnetic power transmission system. This considerably increases not only the stability of such systems, but also the scanning speed, and therefore the reaction speed of the entire system. This inductive transmission path for transmitting power can also be used to exchange digital information in both directions between the stator and rotor unit. Compared to classic systems with separate data cables, or the frequently used wireless transmission links, this function increases reliability, and reduces the installation effort required for data transfer.

Safety laser scanner

Components/Design

In all the systems shown above, the objective is to transmit power and data information from a primary side to a secondary side, with the lowest possible loss factor. In order to increase the efficiency of such units, ferrite core-based coupling coils are required. As well as increasing the power-transmitting magnetic field, the use of optimally designed ferrite cores also leads to a concentration of the magnetic field in the coupling area, and to shielding with respect to the transmission system's external areas.



Inductive transmission cross section

NEOSID is your expert partner in the field of contactless power and signal transmission technology. We offer complex development and manufacturing knowhow, in order to design transmission systems for the widest range of application areas and application requirements.

Development begins with determining the most suitable module components. Here we are able to draw upon a range of existing materials, which have already proven themselves in successful projects a million times. Over the further course of the project, our internal development teams work on the customer project in a focused manner, to design the inductive transmission system, the mechanical construction of the ferrite and housing components, the robot-controlled process technology and up to the in-house creation of the associated test technology. In this way, we ensure the components we produce reliably retain their high quality over their entire life cycle.

Ferrite cores for transmission systems

The magnetically soft ferrite cores play a decisive role in the creation of highly effective transmission systems. Factors such as operating and modulation frequency, operating temperature range, magnetic quality factor and installation situation play an important role when selecting materials.

It is often necessary for the ferrite core in the transmission systems to be made into a special shape, as the installation space in many applications is predefined and limited. If this geometry is too demanding to be produced by pressing, we use a special injection moulding process, which allows us to offer our customers far greater options in terms of shaping.

For this shaping method, the following conditions apply:

- Ferrite material thicknesses from 0.2 mm
- Core volume from 1mm^3 to approx. 8000mm^3
- Standard tolerance ±2%, can be partly reduced to ±1%
- >20 different ferrite raw materials
- Permeabilities from 8 < μ_i < 2000
- No mechanical finishing, such as grinding or milling, necessary
- Direct winding of high-insulation ferrite cores
- Downstream metallisation of ferrite materials on demand, for contact surfaces or shielding areas

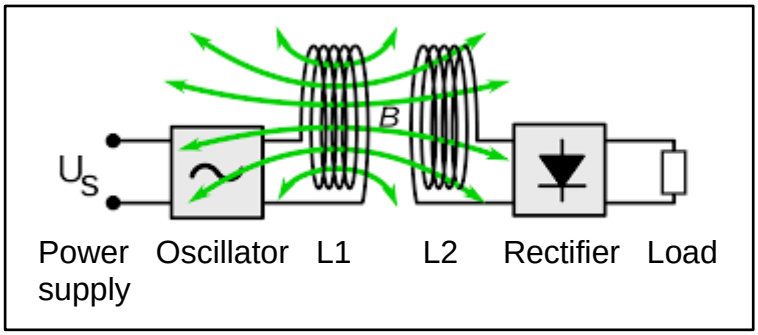
Ferrite pot core

We produce our ferrites in geometries that are otherwise only realized by thermoplastic or thermosetting plastic components.

These advantages allow complex customised ferrite cores to be produced, providing the basis for the production of precise coil systems. With regard to electrical efficiency, mechanical stability and integration in the complete device, these solutions represent a considerable development for this product segment.

Coils for transmission systems

The coil in the transmission system's primary circuit generates an electromagnetic alternating field from the power supply, which induces electrical voltage in the secondary circuit's coil. This supplies the electronic load circuit found there.



Inductive transmission system

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After the winding process, both coils are inserted into the ferrite core. Connection to the electronic control unit on both the primary and secondary sides is made by means of an integrated connector or via direct wiring to a circuit board.

NEOSID manufactures winding wires with diameters from 12µm to 2.5mm. Our manufacturing systems can produce coils with different wire geometries (round and flat wire), with different wire coatings (enamelled wire, stranded wire, HF wire) and using a wide range of bonding methods, fully automatically.

Housing

The housing serves as the coil system's carrier on both the primary and secondary sides. Plastic is usually used for this, as it can be designed on an individual basis, in order to integrate slots for the cores, coils, connectors and any electronic switching components. Means for fixing the coil system into the complete device can also be provided. Thermoplastics or thermosetting materials are used, depending on the required mechanical loads, operating temperature range and chemical resistance.

Before producing a serial tool, the housing components are often initially produced using an additive manufacturing process (3D printing), in order to test the entire system with regard to its mechanical and electrical boundary conditions.

Protecting the coil system

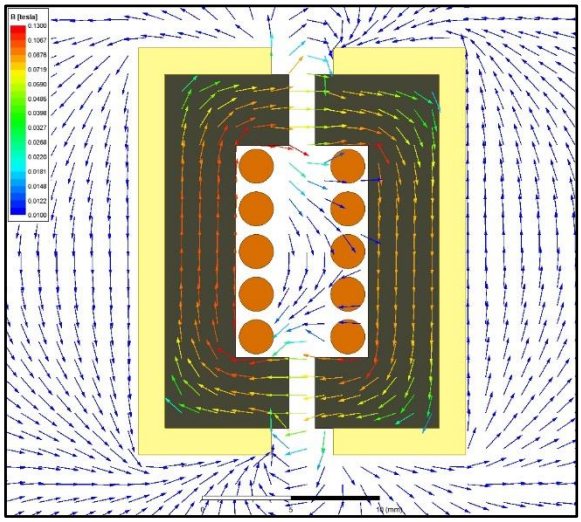
After the coil system has been successfully installed, the entire configuration, comprising ferrite cores, coils and any connectors, is affixed into a housing or a rack. In order to achieve sufficient resistance to real-world environmental conditions, a (vacuum) sealing process is carried out, which seals the system components appropriately.

Product development

Designing the perfect ferrite core for a specific application is one of the greatest challenges of such a project. Taking into consideration special manufacturing methods enables us to harness enhanced design freedoms for their geometry, so that optimum results can be achieved with minimum use of materials. We also work with complex 3D simulation tools, which enable us to examine the effectiveness of our development approaches on a theoretical level. An application-based simulation takes into consideration external influences on the transmission system, for example placing it into a housing made from a ferromagnetic material. Similarly, the effects of axial and radial tolerance windows are determined in 2D and 3D simulations, in order to represent real operating conditions.

Magnetic simulation

For the simulation, we draw upon the technical specifications of more than 20 different ferrite materials. We have a database containing detailed technical descriptions of them. As a result, we can deploy them during the simulation so that the correct material is determined on the basis of all required parameters.



Simulation example of a transmission system

Process technology

Our manufacturing facilities work with the latest production machinery, thus ensuring cost-effective production for different batch sizes. A high manufacturing and testing depth results in an extremely high quality standard, with consistent results across the entire product life cycle.

Tell us your requirements – we will develop the fitting solution!

Have we aroused your interest? Then get in touch with us about the latest generation of inductive power and signal transmission systems.

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