Technology Offer

Detecting electrically conductive foreign objects during inductive power transfer

Background

Inductive power transfer is a contactless transmission technology that can be used to charge the battery of an electric vehicle, for example. Here, the primary coil is embedded in the parking space ground and the secondary coil is integrated into the vehicle's underbody. However, a key problem with this kind of power transfer is that metal objects such as coins or keys can easily get into the transmission field (Fig. 1). Electrically conductive foreign objects are heated in an alternating magnetic field. And excessive heating of a foreign object could potentially cause fires. Therefore, it is required to detect any electrically conductive foreign objects in the transmission field between the primary and secondary coil in order to be able to interrupt the power transmission process, if necessary.

Problem

There are numerous conventional methods for detecting electrically conductive foreign objects (F, Fig. 1) between these coils. Thus, foreign objects can be detected by means of camera monitoring, light barriers, temperature monitoring, measurement of the weight force on the primary coil, monitoring of the electrical parameters of the primary coil or by means of separate sensor coils. However, camera and light systems get dirty easily. And the weight force measurement is affected by rain or snow and is not precise enough for small objects. Temperature monitoring can also be influenced by environmental conditions and, in addition, only detects a foreign object when it has already reached an extremely high temperature. Measurable properties in the primary coil change only slightly when interacting with small foreign objects. This detection method is thus not precise enough and unreliable for small objects.

Solution

A sensor coil (**L3**) is positioned between a primary coil (L1, Fig. 2) and a secondary coil**(L2)**. The current flowing through the sensor coil due to the induced voltage during power transfer is detected and evaluated. The sensor coil is linked to at least one capacitor to form an oscillating circuit which is tuned to the excitation frequency of the primary coil. The ***phase position of the current in the oscillating circuit*** relative to a reference signal is then used to determine whether there are electrically conductive foreign objects (F) between the primary coil and the secondary coil.

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Service
Technologie-Lizenz-Büro GmbH has been entrusted with the exploitation of this technology and assists companies in obtaining licenses.

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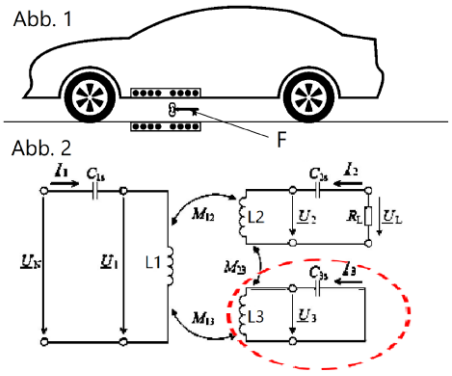

Schematic diagram of the foreign object detection unit according to the invention [Fig: University of Stuttgart

Advantages

- Precise detection of metallic foreign objects
- High sensitivity even to small electrically conductive foreign objects
- Positioning
- Power transmission does not have to be interrupted for foreign object detection
- Sensor winding is embedded in the ground floor primary coil
- No additional parts are needed between the vehicle and the ground

Fields of application

Optimization of wireless charging infrastructure - detection of foreign objects.

Publications and references

M. Böttigheimer: „Methodischer Entwurf von Systemen zur Gefahrenreduktion von metallischen Fremdkörpern beim induktiven Laden von Elektrofahrzeugen“
http://www.shaker.de/de/content/catalogue/index.asp?ID=8&ISBN=978-3-8440-7324-9