High Coupling Characteristics of Coil for Superconducting Wireless Power Transfer

Hui-Seok Gu, Hyo-Sang Choi
Chosun university, South of KOREA

**Abstract**
- Our research team proposed a WPT technique using superconductors. In this paper, a spiral-type coil with a laminated structure was applied as a resonant coil for wireless power transmission for electric vehicles (EV).
- As a result, it is possible to implement wireless power transmission with higher efficiency than the conventional wireless power transmission methods.
- Simulation analysis was performed using High-Frequency Structure Simulation (HFSS), an electromagnetic field analysis program.

**Resonance Coil Design and Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value 1</th>
<th>Value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>φ</td>
<td>1/4</td>
<td>1/4</td>
</tr>
<tr>
<td>M</td>
<td>1/2</td>
<td>1/2</td>
</tr>
<tr>
<td>q</td>
<td>1/4</td>
<td>1/4</td>
</tr>
<tr>
<td>R</td>
<td>1/2</td>
<td>1/2</td>
</tr>
</tbody>
</table>

**Conclusion**
- In this paper, a spiral-type superconducting resonance coil for maximizing the efficiency of wireless power transmission is proposed and analyzed.
- As the transmission resonant coil was laminated, the increase in efficiency was confirmed when a superconductor was applied. Due to the laminated structure, the efficiency was confirmed to be about 7% higher than that of the conventional single layer, and was increased by about 16% when a superconductor was applied.
- Based on the analysis results presented in this paper, it can be concluded that the wireless power transmission efficiency can be maximized when the superconducting spiral-type resonant coil is applied to electric vehicles.
- In addition, it is thought that rapid charging will be made possible by the application of a superconductor during wireless power transmission.

**Simulation results**

- The lower the reflection coefficient and the higher the transmission coefficient, the better the efficiency.
- The transfer factor can be used in the program to indicate efficiency.

\[ \eta = \frac{S_21(T_2, T_1)}{100} \]

**Efficiency measurement method using HFSS program**

![Image of simulation results and parameters]

Presented at the Magnet Technology, 2019 September 22–27, Vancouver, Canada; Program I.D. number: Tue-Af-Po2.24-12 [111]