A Simple Calculation Method for Center Magnetic Flux Density of a Magnetic Core Electromagnet with a Wide Air Gap

Hang XU (1), Shinichi NOMURA(1), Hirohari KAMADA(1), Takanori ISOBE(2), Hirotaka CHIKARAISHI(3), Hiroaki TSUTSUI(4)

(1) Meiji University, Kawasaki, Kanagawa 214-8571, Japan. (2) University of Tsukuba, Tsukuba, Ibaraki, 305-8573, Japan (3) Japan National Institute for Fusion Science, Toki, Gifu 509-5292, Japan. (4) Tokyo Institute of Technology, Meguro-Ku, Tokyo, 152-8550, Japan.

Introduction

Electromagnet with a narrow air gap
Electromagnet with a wide air gap

Magnetic flux distribution of the finite solenoid coil
Magnetic flux distribution in the wide air gap

Formulation for reluctance of the wide air gap and the self-inductance of electromagnet

<table>
<thead>
<tr>
<th>Center magnetic flux density estimation</th>
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<tbody>
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<td>Calculation model for center magnetic flux density of the air gap</td>
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A simple equivalent model of the electromagnet with a wide air gap

Electromagnet with a wide air gap

- Coil windings
- Magnetic core
- Air gap

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Verification experiment using two test electromagnet

Test electromagnet with a constant total magnetic path length
Test electromagnet with a constant magnetic core length

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Correction of the reluctance of Magnetic core

Before the correction:

- Magnetic core reluctance
- Magnetic core length

After the correction:

- Magnetic core reluctance
- Magnetic core length

- Calculation results are agreeing well with the measurement results when the air gap is wide enough.
- Calculation accuracy can be further improved after the correction of the reluctance of the magnetic cores.

Conclusion

- Calculation results are agreeing well with the measurement results when the air gap is wide enough.
- Calculation accuracy can be further improved after the correction of the reluctance of the magnetic cores.