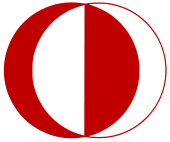
31.03.2020



**MIDDLE EAST TECHNICAL UNIVERSITY**

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

**EE 568** Project #2

***Motor Winding Design & Analysis***

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# Introduction

# Question I: Integral-Slot Winding Design

We have 20-pole 120 slot 3-phase winding. I preferred to design a full pitched winding configuration. The number of slots per pole per phase is 2. Let’s assume that we have double winding configuration. The winding diagram under one pole pair is as follows.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| A1 | A2 | -C3 | -C4 | B1 | B2 | -A3 | -A4 | C1 | C2 | -B3 | -B4 |
| A3 | A4 | -C1 | -C2 | B3 | B4 | -A1 | -A2 | C3 | C4 | -B1 | -B2 |

pitch factor:

distribution factor:

winding factor:

where is harmonics number, is coil span, is number of slots per phase per pole, is electrical angle between two adjacent slots. In our case, is 2, is 30° and is 180°. Since we had full pitched design, our pitch factor is one. Considering this, we got the following results.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Fundamental** | **3rd** | **5th** | **7th** |
| **Pitch factor** | 1 | -1 | 1 | -1 |
| **Distribution factor** | 0,9659 | 0,7071 | 0,2588 | -0,2588 |
| **Winding factor** | 0,9659 | -0,7071 | 0,2588 | 0,2588 |

The results show that the winding factor for the harmonics can be negative. Pitch factor for the third harmonic is negative. This design has high winding factor for the third harmonic component. Therefore, the coil pitch selection may be revisited. There is also considerable winding factor for higher harmonics in the design.

# Question II: Fractional-Slot Winding Design

# Question III: 2D FEA Modelling

# Appendices: XXX