Electrical Drives

Fields of Application 1

(direct current motors & motors for special Applications)

Applied Mechatronics

Module 5.2.3

by Thomas Schmid

Introduction

- Hints for Learning:
  - Read the chapters in the book carefully. (Can also be part of your homework !!!)
  - Use the key questions to work out the essential learning material.
  - Answer the key questions based on the information from the relevant chapter(s).
  - Create an index of the terms of drive technology with a short description continuously.

Fields of Application 1 (1)

- Construction Basics of DC-machines
  - Chapter 2.5: Mech. Aufbau von DC-Maschinen
  - See Tab 2.16 on Page 39 in textbook

Fields of Application 1 (2)

- Direct current (DC) generator
  - Chapter 2.6: Gleichstromgeneratoren
    - DC-Nebenschlussgenerator
    - DC-Reihenschlussgenerator
    - Fremderregter DC-Generator
    - DC-Doppelschlussgenerator
- Terms
  - See Addendum(1-6)

Fields of Application 1 (3)

- Direct current (DC) motor
  - Chapter 2.7: Gleichstrommotoren
    - DC-Nebenschlussmotor
    - DC-Reihenschlussmotor
    - Fremderregter DC-Motor
    - DC-Doppelschlussmotor
- Terms
  - See Addendum(7-8)

Fields of Application 1 (4)

- Direct current (DC) motor (continued)
  - Chapter 2.8: Drehzahlsteuerung von DC-Motoren
  - Chapter 2.9: Störungsursachen bei DC-Motoren

  - See Tab.2.20 on Page 52 in textbook

Fields of Application 1 (5)

- Motors for special applications
  - Chapter 2.23: Universalmotor
  - Chapter 2.25: Spaltpolmotor
  - Chapter 2.26: Servomotor
  - Chapter 2.27: Schrittmotor

Fields of Application 1 (6)

- Motors for special applications (continued)
  - Chapter 2.28: Repulsionsmotor
  - Chapter 2.29: Reluktanzmotor
- Power electronics for drives
  - Chapter 2.30: Leistungselektronik…

Addendum (1)

- Terms
  - Change of magnetic flux $\Delta\phi$
    - Unit: Weber $[Wb]$
  - Time difference Δt
    - Unit: Seconds $[s]$
  - Number of windings N
    - Unit: no

Addendum (2)

- Terms (continued)
  - Induced voltage U_{ind}
    - Unit: Volts $[V\ ]$
    - Relation: $U_{ind} = N \cdot \frac{\Delta\Phi}{\Delta t}$

      Law of induction (Induktionsgesetz)

Addendum (3)

- Terms
  - Magnetic flux density *B*
    - Unit: Tesla *[T]*
  - Conductor length ***l***
    - Unit: Meters *[m]*
  - Velocity *v*
    - Unit: Meters per second *[m/s]*
  - Number of conductors *z*
    - Unit: no

Addendum (4)

- Terms (continued)
  - Induced voltage U_0
    - Unit: Volts $[V]$
    - Relation: $U_0 = B \cdot l \cdot v \cdot z$

      → *derived from Law of induction (abgeleitet vom Induktionsgesetz)*

Addendum (5)

- Terms (continued)
  - Rotation speed n
    - Unit: Rotations per minute $[^1/_{min}]$
  - Excitation field ϕ_E
    - Unit: Weber *[Wb]*
  - Electrical output constant c_e
    - Unit: no
  - Armature current I_A and armature resistance R_A
    - Unit: Ampere *[A]* Unit: Ohms *[Ω]*

Addendum (6)

- Terms (continued)

  The generator equation (Generatorgleichung)

  – Output voltage U
    - Unit: Volts $[V]$
    - Relation: $U = c_e \cdot \phi_E \cdot n - (I_A \cdot R_A)$
    - Relation: $U = U_0 - U_i$
  – Internal voltage U_i
    - Unit: Volts $[V]$
    - Relation: $U_i = (I_A \cdot R_A)$

Addendum (7)

- Terms (continued)

  The torque equation (Momentgrundgleichung)

  – Mechanical output constant c_m
    - Unit: no

  – Torque M
    - Unit: Newtonmeter $[Nm]$
    - Relation: $M = c_m \cdot \phi_E \cdot I_A$

Addendum (8)

- Terms (continued)

  <u>The motor speed equation (Motorgrundgleichung)</u>

  – Rotation speed *n*
    - Unit: Rotations per minute $[^1/_{min}]$
    - Relation: $n = \frac{U - I_A \cdot R_i}{c_E \cdot \phi_E}$

Bibliography

- Briegler, Adolf; Holzer, Helmut and others. *Elektrotechnik Fachkunde 1*. Wien: Jugend & Volk, 2013. ISBN: 978-3-7100-2911-0.