Electrical, Controls, Instrumentation

Ricky Nguyen's knowledge bank

EC&I Knowledge Encyclopedia

Changed by:	Date	Comment
Ricky N.	16/07/2022	

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1 UQ Subjects

This chapter goes through the UQ courses that was undertaken from 2016-2019. The format will be as follows, for each section, where possible:

1. Lecture notes (Use "LEC##: TITLE HERE" for each heading)
2. Tutorial questions (Use "TUT##: TITLE HERE" for each heading)
3. Summary of all equations used (Use "EQU##: TITLE HERE" for each heading)
4. References & other helping material (Use "REF##: TITLE HERE" for each heading)
5. Australian Standards (Use "STD##: TITLE HERE" for each heading)

In terms of text colour and highlights, the format will be as follows where possible:

1. Black = normal text
2. Red = Important
3. Blue = Equation & Weblinks

1.1 CSSE2002 - Java Language

1.2 CSSE2010 - Embedded Programming

1.3 CSSE2310 - C Language

1.4 CSSE3010 - Advanced Embedded

1.5 MATH1051 - Linear Calculus

1.6 MATH2001 - Advanced Calculus

1.7 MATH2010 - Partial Differential Equations

1.8 STAT2202 - Advanced Statistics

1.9 ELEC2003 - Electronics & Circuits Pt.1

1.10 ELEC2004 - Electronics & Circuits Pt.2

1.10.1 LEC01: Capacitors and Inductors, RL and RC Circuits

Capacitors

Capacitors and inductors are linear circuit elements that can store electrical energy. The ideal capacitor stores energy in the form of charge.

$$C = \frac{\epsilon A}{d} \tag{1}$$

Where:

- C = capacitance in Farads (F)
- A = conductor plates area (both top and bottom) (mm^2)
- ϵ = dielectric of permitivity (constant)
- d = plate separation distance (m)

$$Q = CV \tag{2}$$

Where:

- Q = stored charge
- C = capacitance (F)
- V = applied voltage (V)

In DC, a capacitor is effectively an open circuit; when a steady voltage is applied. When the voltage changes, the stored charge changes also as per equation (2) by taking the derivative. Thus,

$$i(t) = \frac{dq(t)}{dt} = C\frac{dv(t)}{dt} \tag{3}$$

Energy storage in capacitors is calculated by integrating the instantaneous power $P(t)$. Thus,

$$P(t) = v(t)i(t) = Cv(t)\frac{dv(t)}{dt} \tag{4}$$

Integrating the instanteous power:

$$W(t) = \frac{1}{2}Cv^2(t) \tag{5}$$

Capacitors can be combined in series and in parallel to yield a single equivalent capacitance. Note: the behaviour of equivalent capacitance is the opposite of resistors. Series:

$$C_{EQ} = \frac{1}{\frac{1}{C_1} + \frac{1}{C_1} + \frac{1}{C_1}...} \tag{6}$$

Parallel:

$$C_{EQ} = C_1 + C_2 + C_3... \tag{7}$$

1.11 ELEC3100 - Advanced Electrical Theory

1.12 ELEC3300 - Motors & Electrical Energy

1.13 ELEC3400 - Amplifiers & Electronics

1.14 ELEC4300 - Power System Analysis

1.15 ELEC4302 - Power System Protection

1.16 ELEC4620 - Signal Processing

1.17 ELEC4630 - Image Processing

1.18 ENGG4800 - Project Management

1.19 METR4201 - Control System Analysis