A3 Simulative Engineering - Formulary

Contents

1 Resources for the exam

Allowed:

- ✓ Your hand written Lecture notes
- ✓ Summary of your handwritten lectures
- ✓ This formulary
- ✓ Mathematical book e.g.Papula
- ✓ DHBW Calculator (or just use MATLAB)

Not allowed:

- × Solutions of the laboratory
- × Learning paper

2 Laplace

How to transform signals?

Derivatives	Integrals
$y(t) \circ\!\!-\!\!\bullet Y(s)$	$\int y(t)dt \circ\!\!-\!\!\bullet \frac{1}{s}Y(s)$
$y'(t) \circ\!\!-\!\!\bullet sY(s)$	$\int\int y(t)dt \circ\!\!-\!\!\bullet \frac{1}{s^2}Y(s)$
$y''(t) \circ\!\!-\!\!\bullet s^2Y(s)$	$\int\int\int y(t)dt \circ\!\!-\!\!\bullet \frac{1}{s^3}Y(s)$
and so on...	and so on...

3 Electronical formulas

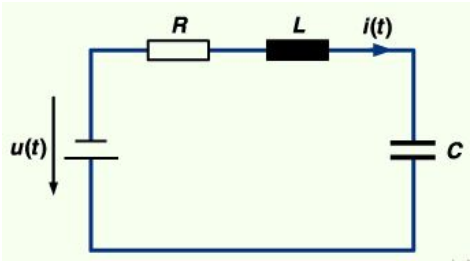

Figure 1: RLC circuit

3.1 Resistor

$$u_R(t) = R \cdot i_R(t) \tag{1}$$

U: voltage [Volt V]
R: restistance [Ohm $\Omega = \frac{V}{A}$]
I: current [Ampere A]

3.2 Capacitor/Condenser

$$Q = C \cdot U_C \tag{2}$$

$$Q = \int i_C(t) \tag{3}$$

$$i_C(t) = C \cdot u'_C(t) \tag{4}$$

Q: electric charge [Coulomb C = As]
C: capacity [Farad F = $\frac{C}{V}$]

3.3 Inductor

$$u_L(t) = L \cdot i'_L(t) \tag{5}$$

L: inductance [Henry H = $\frac{Vs}{A}$]

4 Mechanical formulas

4.1 Newton's Second Law

$$F = m \cdot a = m \cdot x''(t) \tag{6}$$

m: mass [gramm g]
a: acceleration $[\frac{m}{s^2}]$ x: length [meter m]

4.2 Gravitational force

$$F_G = m \cdot g \tag{7}$$

g: gravitational acc. $[\frac{m}{s^2}]$ (Germany 9.81 $\frac{m}{s^2}$)

4.3 Spring force

$$F_S = k \cdot x \tag{8}$$

k: spring constant $[\frac{kg}{s^2}]$

4.4 Friction force

$$F_F = r \cdot v = r \cdot x'(t) \tag{9}$$

r: friction constant
v: velocity $[\frac{m}{s}]$

4.5 Rotational force

$$F_R = F_G \cdot \sin \rho \tag{10}$$

ρ: angle of displacement

4.6 Torque

$$M = F \cdot r \tag{11}$$

r: radius

4.7 Rotational movement

$$M = J \cdot \rho'' \tag{12}$$

J: moment of inertia
ρ'': angular velocity