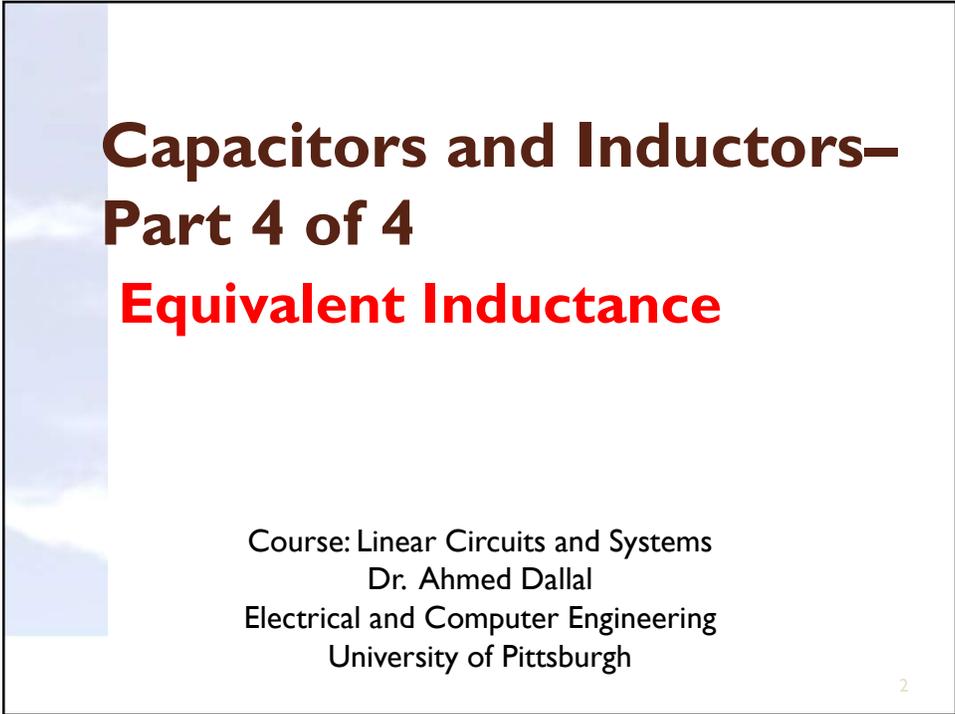Linear Circuits and Systems

Capacitors and Inductors– Part 4 of 4
Equivalent Inductance

Course: Linear Circuits and Systems
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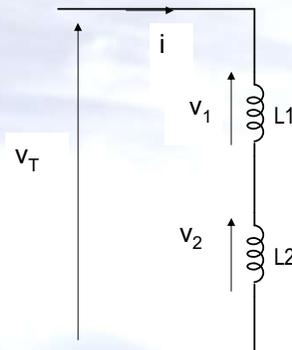
Reminder: Voltage-current relationship

Inductor is a dynamic element whose voltage current relationship is given as:

$$v = L\frac{di}{dt} \qquad\qquad i = \frac{1}{L}\int v\,dt$$

Inductors in series

- What is the equivalent inductance of two inductors in series?

Inductors in series
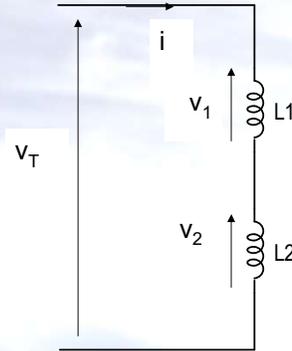
$$v = L\frac{di}{dt}$$

$$v_T = v_1 + v_2$$
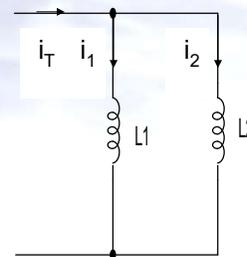
$$L_T\frac{di}{dt} = L_1\frac{di}{dt} + L_2\frac{di}{dt}$$

$$L_T = L_1 + L_2$$

In general $$L_T = L_1 + L_2 + \ldots\ldots L_n$$

Inductors in parallel

- What is the equivalent inductance of two inductors in parallel?
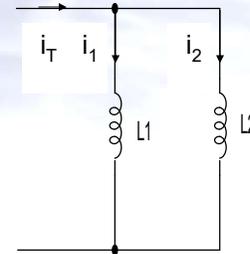
Inductors in parallel

$$i = \frac{1}{L}\int v dt$$

$$i_T = i_1 + i_2$$

$$\frac{1}{L_T}\int v dt = \frac{1}{L_1}\int v dt + \frac{1}{L_2}\int v dt$$

$$\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2}$$

In general

$$\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2} + \ldots\ldots + \frac{1}{L_n}$$
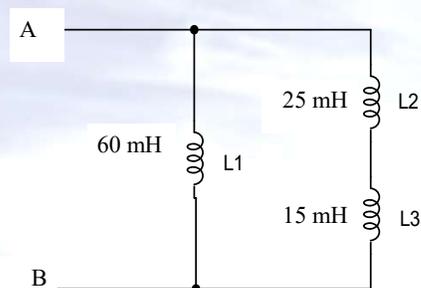
$i_T \quad i_1 \qquad i_2$

L1 \qquad L2

Example

Effective inductance between A and B is:

$L_s = L_2 + L_3 = 25 + 15 = 40$ mH

$L_t = (L_1 \times L_s)/(L_1 + L_s)$

$= (60 \times 40)/(60 + 40) = 24$ mH

A

25 mH \quad L2

60 mH \quad L1

15 mH \quad L3

B

4

Conclusion

Acknowledgement

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THE END