

F16Q4 - Trådløse Sensor Netværk og Elektronik [240112U171]
 LAB 1 - Energy/Power lab exercise

$$P_{mote}(t) = U_{mote}(t) \cdot I_{mote}(t)$$

$$E_{mote} = \int_{t_0}^{t_1} P_{mote}(t) dt$$

We need to find $U_{mote}(t)$ and $I_{mote}(t)$

$$U_{mote}(t) = U_{battery}(t) - U_{shunt}(t)$$

$$I_{mote}(t) = I_{shunt}(t) = \frac{U_{shunt}(t)}{R_{shunt}}$$

We need to find $U_{shunt}(t)$, R_{shunt} and $U_{battery}(t)$

Red LED Blink, 100 ms between flash

$$U_{battery}(t) := 3.1 \text{ V} \quad t_0 := 0 \text{ s}$$

$$U_{shunt}(t) := 1.7 \text{ mV} \quad t_1 := 5 \text{ s}$$

$$R_{shunt} := 10 \Omega$$

$$U_{mote}(t) := U_{battery}(t) - U_{shunt}(t) \rightarrow 3.1 \cdot V + -1.7 \cdot mV = 3.098 \text{ V}$$

$$I_{mote}(t) := \frac{U_{shunt}(t)}{R_{shunt}} \rightarrow \frac{0.17 \cdot mV}{\Omega} = (1.7 \cdot 10^{-4}) \text{ A}$$

$$P_{mote}(t) := U_{mote}(t) \cdot I_{mote}(t) \rightarrow 0.000526711 \cdot A \cdot V$$

$$E_{mote} := \int_{t_0}^{t_1} P_{mote}(t) dt = 0.003 \text{ J}$$

Red LED ON

$$U_{battery}(t) := 3.1 \text{ V} \quad t_0 := 0 \text{ s}$$

$$U_{shunt}(t) := 24.9 \text{ mV} \quad t_1 := 60 \text{ s}$$

$$R_{shunt} := 10 \Omega$$

$$U_{mote}(t) := U_{battery}(t) - U_{shunt}(t) \rightarrow 3.1 \cdot V + -24.9 \cdot mV = 3.075 \text{ V}$$

$$I_{mote}(t) := \frac{U_{shunt}(t)}{R_{shunt}} \rightarrow \frac{2.49 \cdot mV}{\Omega} = 0.002 \text{ A}$$

$$P_{mote}(t) := U_{mote}(t) \cdot I_{mote}(t) \rightarrow 0.007656999 \cdot A \cdot V$$

$$E_{mote} := \int_{t_0}^{t_1} P_{mote}(t) dt = 0.459 \text{ J}$$

Green LED ON

$$U_{battery}(t) := 3.1 \text{ V} \quad t_0 := 0 \text{ s}$$

$$U_{shunt}(t) := 46 \text{ mV} \quad t_1 := 60 \text{ s}$$

$$R_{shunt} := 10 \Omega$$

$$U_{mote}(t) := U_{battery}(t) - U_{shunt}(t) \rightarrow 3.1 \cdot V - 46 \cdot mV = 3.054 \text{ V}$$

$$I_{mote}(t) := \frac{U_{shunt}(t)}{R_{shunt}} \rightarrow \frac{23 \cdot mV}{5 \cdot \Omega} = 0.005 \text{ A}$$

$$P_{mote}(t) := U_{mote}(t) \cdot I_{mote}(t) \rightarrow 0.0140484 \cdot A \cdot V$$

$$E_{mote} := \int_{t_0}^{t_1} P_{mote}(t) dt = 0.843 \text{ J}$$

Blue LED ON

$$U_{battery}(t) := 3.1 \text{ V} \quad t_0 := 0 \text{ s}$$

$$U_{shunt}(t) := 16 \text{ mV} \quad t_1 := 60 \text{ s}$$

$$R_{shunt} := 10 \Omega$$

$$U_{mote}(t) := U_{battery}(t) - U_{shunt}(t) \rightarrow 3.1 \cdot V - 16 \cdot mV = 3.084 \text{ V}$$

$$I_{mote}(t) := \frac{U_{shunt}(t)}{R_{shunt}} \rightarrow \frac{8 \cdot mV}{5 \cdot \Omega} = 0.002 \text{ A}$$

$$P_{mote}(t) := U_{mote}(t) \cdot I_{mote}(t) \rightarrow 0.0049344 \cdot A \cdot V$$

$$E_{mote} := \int_{t_0}^{t_1} P_{mote}(t) dt = 0.296 \text{ J}$$

Tx, 250 ms between

$$U_{battery}(t) := 3.1 \text{ V} \quad t_0 := 0 \text{ s}$$

$$U_{shunt}(t) := 185 \text{ mV} \quad t_1 := 60 \text{ s}$$

$$R_{shunt} := 10 \Omega$$

$$U_{mote}(t) := U_{battery}(t) - U_{shunt}(t) \rightarrow 3.1 \cdot V - 185 \cdot mV = 2.915 \text{ V}$$

$$I_{mote}(t) := \frac{U_{shunt}(t)}{R_{shunt}} \rightarrow \frac{37 \cdot mV}{2 \cdot \Omega} = 0.019 \text{ A}$$

$$P_{mote}(t) := U_{mote}(t) \cdot I_{mote}(t) \rightarrow 0.0539275 \cdot A \cdot V$$

$$E_{mote} := \int_{t_0}^{t_1} P_{mote}(t) dt = 3.236 \text{ J}$$

Rx and Tx, 250 ms between

$$U_{battery}(t) := 3.1 \text{ V} \quad t_0 := 0 \text{ s}$$

$$U_{shunt}(t) := 215 \text{ mV} \quad t_1 := 60 \text{ s}$$

$$R_{shunt} := 10 \Omega$$

$$U_{mote}(t) := U_{battery}(t) - U_{shunt}(t) \rightarrow 3.1 \cdot V - 215 \cdot mV = 2.885 \text{ V}$$

$$I_{mote}(t) := \frac{U_{shunt}(t)}{R_{shunt}} \rightarrow \frac{43 \cdot mV}{2 \cdot \Omega} = 0.022 \text{ A}$$

$$P_{mote}(t) := U_{mote}(t) \cdot I_{mote}(t) \rightarrow 0.0620275 \cdot A \cdot V$$

$$E_{mote} := \int_{t_0}^{t_1} P_{mote}(t) dt = 3.722 \text{ J}$$