

Practical Work No. 02: Short Lines

1. Objective of the Practical Work

- Study of a short line: no-load test and load test (R, RL, and RC),
- Influence of the load on electrical quantities (voltage and current).

2. Preparation work

- The circuit in Figure 1 has a receiver which is a load R, R-L, and R-C in series.
- The parameters are: $R_L=10(\Omega)$, $L_L=10\text{mH}$, $R_{\text{Load}}=340 \text{ ohm}$, $L_{\text{Load}}= 1 \text{ H}$, $C_{\text{Load}}=9.4 \text{ }\mu\text{F}$, and $V_s=80 \text{ V}$, $f=50\text{Hz}$.
- Complete Table 1 by calculating the following values: I_s , I_r , V_r , P_s , P_r , Q_s , Q_r , $\cos(\phi_s)$, $\cos(\phi_r)$, and η .
- Calculate the efficiency in both cases (R_{Load} , $R_{\text{Load}} L_{\text{Load}}$, and $R_{\text{Load}} C_{\text{Load}}$).
- Draw the vector diagram for a resistive load (R), inductive load (R-L) and capacitive load (R-C).

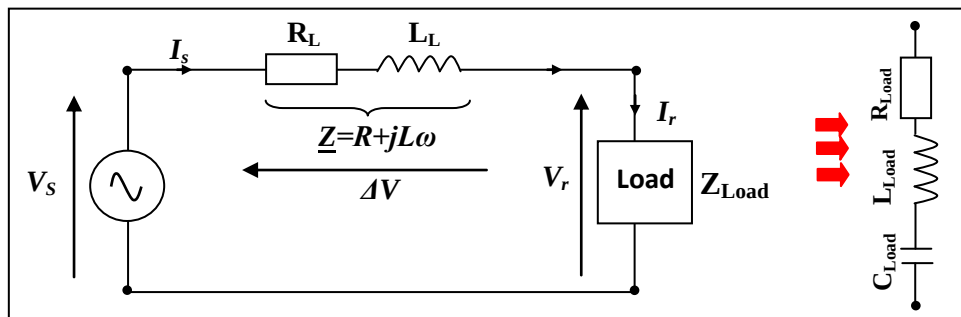


Figure 1. R, R-L, and R-L-C circuits.

Table 1.

		Source						Receiver						$\eta (\%) = \frac{P_r}{P_s}$
		V_s (V)	I_s (A)	P_s (w)	Q_s (VAR)	S_s (VA)	$\cos \phi_s$	V_r (V)	I_r (A)	P_r (w)	Q_r (VAR)	S_r (VA)	$\cos \phi_r$	
Loads	R_{Load}	80											1,00	
	$R_{\text{Load}}, L_{\text{Load}}$	80												
	$R_{\text{Load}}, C_{\text{Load}}$	80												

3. Practical Study

3.1. No-Load Test (K_{Open})

Implement the following setup:

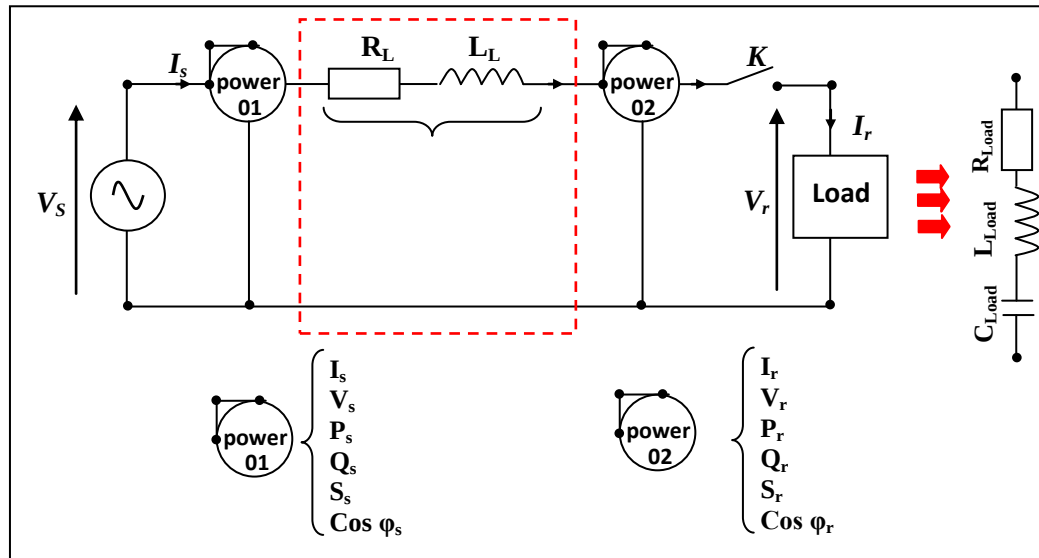


Figure 2. Short line.

Given: $R_L = \dots\dots\dots \Omega$, $L_L = \dots\dots\dots H$, $V_s = 80 V$, then $V_s = 100 V$.

- Record in a table: I_s , I_r , V_r , P_s , P_r , Q_s , Q_r , $\cos(\phi_s)$, and $\cos(\phi_r)$.
- Calculate the efficiency in both cases, (80V and 100V).

Source						Receiver						$\eta = P_r / P_s$ (%)
V_s (V)	I_s (A)	P_s (w)	Q_s (VAR)	S_s (VA)	$\cos \phi_s$	V_r (V)	I_r (A)	P_r (w)	Q_r (VAR)	S_r (VA)	$\cos \phi_r$	
80 V							0	0	0	0	//	
100 V							0	0	0	0	//	

3.2. R Load (K_{Closed})

Implement the setup from Figure 2 with a resistive (R) load:

- Given: $R_L = \dots\dots\dots \Omega$, $L_L = \dots\dots\dots H$, and $V_s = 80 V$.
- Vary the load R_{Load} .
- For each variation of L_{Load} , measure the following quantities: I_s , I_r , V_r , P_s , P_r , Q_s , Q_r , $\cos(\phi_s)$, $\cos(\phi_r)$.
- Calculate the efficiency in both cases ($R_{Load 1}$ and $R_{Load 2}$).

	Source						Receiver						$\eta = P_r / P_s$ (%)	$\eta = P_r / P_s$ (%)
	V_s (V)	I_s (A)	P_s (w)	Q_s (VAR)	S_s (VA)	$\cos \phi_s$	V_r (V)	I_r (A)	P_r (w)	Q_r (VAR)	S_r (VA)	$\cos \phi_r$	$R_{Load 1}$	$R_{Load 2}$
$R_{Load 1} = \dots\dots\dots \Omega$	80											1		
$R_{Load 2} = \dots\dots\dots \Omega$	80											1		

3.3.R-L Load (K_{Closed})

Implement the setup from Figure 2, where the receiver is an R-L load in series:

- Given: $R_L = \dots \Omega$, $L_L = \dots H$, $R_{Load} = \dots \Omega$ (fixed), and $V_s = 80 V$.
- Vary the load L_{Load} .
- For each variation of L_{Load} , measure the following quantities: I_s , I_r , V_r , P_s , P_r , Q_s , Q_r , $\cos(\phi_s)$, $\cos(\phi_r)$.
- Calculate the efficiency in both cases ($L_{Load 1}$ and $L_{Load 2}$).

		Source						Receiver						η (%) $L_{Load 1}$	η (%) $L_{Load 2}$
		V_s (V)	I_s (A)	P_s (W)	Q_s (VAR)	S_s (VA)	$\cos \phi_s$	V_r (V)	I_r (A)	P_r (W)	Q_r (VAR)	S_r (VA)	$\cos \phi_r$		
$R_{Load} = \dots \Omega$	$L_{Load 1} = \dots H$	80													
	$L_{Load 2} = \dots H$	80													

3.4.R-C Load (K_{Closed})

Implement the setup from Figure 2, where the receiver is an R-L load in series:

- Given: $R_L = \dots \Omega$, $L_L = \dots H$, $R_{Load} = \dots \Omega$ (fixed), and $V_s = 80 V$.
- Vary the load C_{Load} .
- For each variation of C_{Load} , measure the following quantities: I_s , I_r , V_r , P_s , P_r , Q_s , Q_r , $\cos(\phi_s)$, $\cos(\phi_r)$.
- Calculate the efficiency in both cases ($C_{Load 1}$ and $C_{Load 2}$).

		Source						Receiver						η (%) $C_{Load 1}$	η (%) $C_{Load 2}$
		V_s (V)	I_s (A)	P_s (W)	Q_s (VAR)	S_s (VA)	$\cos \phi_s$	V_r (V)	I_r (A)	P_r (W)	Q_r (VAR)	S_r (VA)	$\cos \phi_r$		
$R_{Load} = \dots \Omega$	$C_{Load 1} = \dots \mu F$	80													
	$C_{Load 2} = \dots \mu F$	80													

4. Required Work

- Plot the curves: $V_r = f(I_r)$; $\cos(\phi_r) = f(I_r)$.
- Interpret the obtained results.
- Explain the influence of different types of loads on electrical quantities and active and reactive powers.
- Suggest how to improve the efficiency of the electrical line.
- Provide a general conclusion for this practical work.