Homework for Analogue Electronics

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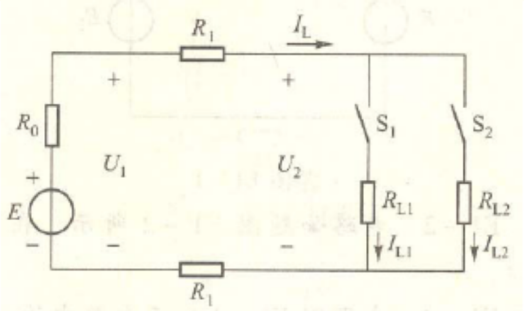
E1－10　有一电动势 E 为 230 V，内阻为 R_0 的直流电源，经两根电阻为 R_1 的供电线对负载供电，如题图 E1－10 所示。求：

（1）当接入 R_{L1} 时，负载电流 $I_L=2$ A，电源端电压 $U_1=228$ V，负载端电压 $U_2=224$ V，求 R_0，R_1 和 R_{L1} 的值；

（2）当电路又接入负载 R_{L2} 后，负载电流 $I_L=10$ A。试求 U_1，U_2，I_{L1}，I_{L2}，R_{L2} 各为多少？



题图 E1－10

Solution for question 1　When S_1 is closed

$$\begin{aligned} U_1 - I_L(2R_1) - U_2 &= 0 \\ E + I_L R_0 &= U_1 \\ U_2 &= I_L R_{L1} \end{aligned}$$

$$\begin{aligned} R_1 &= 1\ \Omega \\ R_0 &= 1\ \Omega \\ R_{L1} &= 112\ \Omega \end{aligned}$$

Solution for question 2　The parallel resistance of R_{L1} and R_{L2} is

$$R = \frac{R_{L1}R_{L2}}{R_{L1}+R_{L2}}$$

From the Kirchhoffs Voltage Law

$$\begin{aligned} E - I_L R_0 &= U_1 \\ I_L R &= U_2 \\ E - I_L\left(R_0 + 2R_1 + R\right) &= 0 \end{aligned}$$

From which we can get

$$R = 20\ \Omega$$
$$U_1 = 220\ \text{V}$$
$$U_2 = 200\ \text{V}$$

$$I_{L1} = \frac{U_2}{R_{L1}} = 1.79\ \text{A}$$
$$I_{L2} = I_L - I_{L1} = 8.21\ \text{A}$$
$$R_{L2} = \frac{U_2}{I_{L2}} = 24.36\ \Omega$$