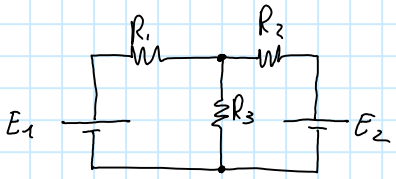
Principio di sovrapposizione degli effetti

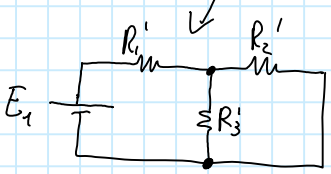
martedì 24 gennaio 2023 08:45

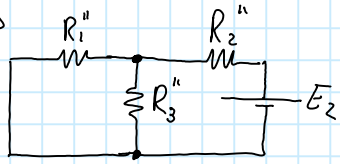
J.



$E_1 = 10\,V$
$E_2 = 5\,V$
$R_1 = 10\,\Omega$
$R_2 = 20\,\Omega$
$R_3 = 10\,\Omega$

$I_{R_3} = ?$





$$R_{P23} = \frac{R_2' \cdot R_3'}{R_2' + R_3'} = \frac{20 \cdot 10}{20+10} = \frac{200}{30} = \frac{20}{3}\,\Omega$$

$$R_{S1} = R_1' + R_{P23} = 10 + \frac{20}{3} = \frac{50}{3}\,\Omega$$

$$I_{R_{S1}} = \frac{E_1}{R_{S1}} = \frac{10}{\frac{50}{3}} = \frac{30}{50} = \frac{3}{5}\,A$$

$$V_{R_{P23}} = R_{P23} \cdot I_{R_{S1}} = \frac{4}{\cancel{30}} \cdot \frac{\cancel{3}}{\cancel{5}} = 4V$$

$$V_{R_{P23}} = V_{R_3'}$$

$$I_{R_3}' = \frac{V_{R_3'}}{R_3'} = \frac{4}{10}\,A$$

$$R_{P_{13}} = \frac{R_1'' \cdot R_3''}{R_1'' + R_3''} = \frac{10 \cdot 10}{10+10} = 5\,\Omega$$

$$R_{S2} = R_2'' + R_{P13} = 20 + 5 = 25\,\Omega$$

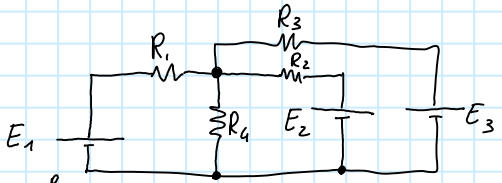
$$I_{R_{S2}} = \frac{E_2}{R_{S2}} = \frac{5}{25} = \frac{1}{5}\,A$$

$$V_{R_{P13}} = I_{R_{S2}} \cdot R_{P13} = \frac{1}{5} \cdot 5 = 1V$$

$$V_{R_{P13}} = V_{R_3''} = 1V$$

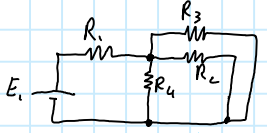
$$I_{R_3}'' = \frac{V_{R_3''}}{R_3''} = \frac{1}{10}\,A$$

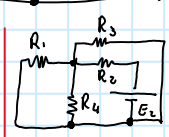
$$I_{R_3} = I_{R_3}' + I_{R_3}'' = \frac{4}{10} + \frac{1}{10} = \frac{5}{10} = \frac{1}{2}\,A$$

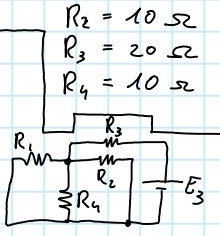


$E_1 = 10V$
$E_2 = 5V$
$E_3 = 10V$
$R_1 = 10\,\Omega$
$R_2 = 10\,\Omega$
$R_3 = 20\,\Omega$
$R_4 = 10\,\Omega$

$I_{R_4} = ?$







$$R_P' = \frac{1}{\frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}} = \frac{1}{\frac{1}{10} + \frac{1}{20} + \frac{1}{10}}$$

$$R_P'' = \frac{1}{\frac{1}{R_1} + \frac{1}{R_3} + \frac{1}{R_4}} = \frac{1}{\frac{1}{10} + \frac{1}{20} + \frac{1}{10}} = 4\,\Omega$$

$$R_P''' = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_4}} = \frac{1}{\frac{1}{10} + \frac{1}{10} + \frac{1}{10}} = \frac{1}{\frac{3}{10}} = \frac{10}{3}\,\Omega$$

$R_p = \frac{1}{\frac{1}{R_2}+\frac{1}{R_3}+\frac{1}{R_4}} = \frac{1}{\frac{1}{10}+\frac{1}{20}+\frac{1}{10}} = \frac{1}{\frac{5}{20}} = \frac{20}{5} = 4\,\Omega$

$R_S' = R_1 + R_p' = 10 + 4 = 14\,\Omega$

$I_{R_S}' = \frac{E_1}{R_S'} = \frac{10}{14} = \frac{5}{7}\,A$

REGOLETTA MAGICA (SERIE)

$I_{R_S}' = I_{R_1} = I_{R_p}$

$V_{R_p}' = R_p' \cdot I_{R_p}' = 4 \cdot \frac{5}{7} = \frac{20}{7}\,V$

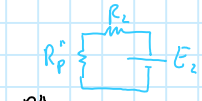
ALTRA REGOLETTA MAGICA (PARALLELO)

$V_{R_p}' = V_{R_2} = V_{R_3} = V_{R_4}$

$I_{R_4}' = \frac{V_{R_4}}{R_4} = \frac{\frac{20}{7}}{10} = \frac{\frac{20}{7}}{1} \cdot \frac{1}{10} = \frac{2}{7}\,A$

$\frac{1}{R_2}+\frac{1}{R_3}+\frac{1}{R_4} = \frac{1}{10}+\frac{1}{20}+\frac{1}{10} = 4\,\Omega$

$R_S'' = R_2 + R_p'' = 10 + 4 = 14\,\Omega$



$I_{R_S}'' = \frac{E_2}{R_S''} = \frac{5}{14}\,A$

REGOLETTA MAGICA (SERIE)

$I_{R_S}'' = I_{R_2} = I_{R_p}''$

$V_{R_p}'' = R_p'' \cdot I_{R_p}'' = 4 \cdot \frac{5}{14} = \frac{10}{7}\,V$

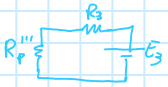
REGOLETTA MAGICA (PARALLELO)

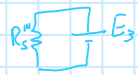
$V_{R_p}'' = V_{R_1} = V_{R_3} = V_{R_4}$

$I_{R_4}'' = \frac{V_{R_1}}{R_4} = \frac{\frac{10}{7}}{10} = \frac{10}{7} \cdot \frac{1}{10} = \frac{1}{7}\,A$

$\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_4} = \frac{1}{\frac{1}{10}+\frac{1}{10}+\frac{1}{10}} = \frac{1}{\frac{3}{10}} = \frac{10}{3}\,\Omega$

$R_S''' = R_3 + R_p''' = 20 + \frac{10}{3} = \frac{70}{3}\,\Omega$





$I_{R_S'''} = \frac{E_3}{R_S'''} = \frac{10}{\frac{70}{3}} = \frac{10 \cdot 3}{70} = \frac{3}{7}\,A$

REGOLETTA MAGICA (SERIE)

$I_{R_S'''} = I_{R_3} = I_{R_p'''}$

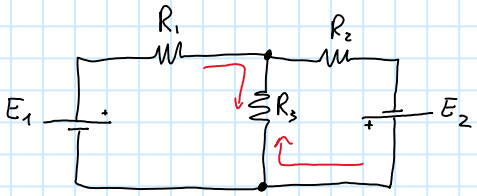
$V_{R_p'''} = R_p''' \cdot I_{R_p'''} = \frac{10}{3} \cdot \frac{3}{7} = \frac{10}{7}\,V$

REGOLETTA MAGICA (PARALLELO)

$V_{R_p'''} = V_{R_1} = V_{R_2} = V_{R_4}$

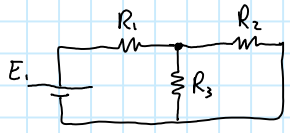
$I_{R_4}''' = \frac{V_{R_4}}{R_4} = \frac{\frac{10}{7}}{10} = \frac{10}{7} \cdot \frac{1}{10} = \frac{1}{7}\,A$

$$I_{R_4} = I_{R_4}' + I_{R_4}'' + I_{R_4}''' = \frac{2}{7} + \frac{1}{7} + \frac{1}{7} = \boxed{\frac{4}{7}\,A}$$

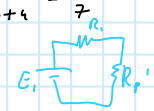


$R_1 = 2\,\Omega$
$R_2 = 3\,\Omega$
$R_3 = 4\,\Omega$
$E_1 = 10\,V$
$E_2 = 5\,V$

$I_{R_3} = ?$



$R_p' = \frac{R_2 \cdot R_3}{R_2 + R_3} = \frac{3 \cdot 4}{3+4} = \frac{12}{7}\,\Omega$



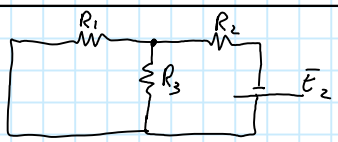
$R_S' = R_1 + R_p' = 2 + \frac{12}{7} = \frac{26}{7}\,\Omega$

$I_{R_S}' = \frac{E_1}{R_S'} = \frac{10}{\frac{26}{7}} = 10 \cdot \frac{7}{26} = \frac{35}{13}\,A$

REGOLETTA MAGICA (SERIE)

$I_{R_S}' = I_{R_1} = I_{R_p'}$

$V_{R_p}' = R_p' \cdot I_{R_p}' = \frac{12}{7} \cdot \frac{35}{13} = \frac{60}{13}\,V$



$R_p'' = \frac{R_1 \cdot R_3}{R_1 + R_3} = \frac{2 \cdot 4}{2+4} = \frac{8}{6} = \frac{4}{3}\,\Omega$

$R_S'' = R_2 + R_p'' = 3 + \frac{4}{3} = \frac{13}{3}\,\Omega$

$I_{R_S}'' = \frac{E_2}{R_S''} = \frac{5}{\frac{13}{3}} = 5 \cdot \frac{3}{13} = \frac{15}{13}\,A$

REGOLETTA MAGICA (SERIE)

$I_{R_S}'' = I_{R_p}'' = I_{R_2}$

$V_{R_p}'' = R_p'' \cdot I_{R_p}'' = \frac{4}{3} \cdot \frac{15}{13} = \frac{20}{13}\,V$

REGOLETTA MAGICA (PARALLELO)

$I_{R_S}' = I_{R_1} = I_{R_P}'$

$V_{R_P}' = R_P' \cdot I_{R_P}' = \frac{12}{7} \cdot \frac{35}{13} = \frac{60}{13}$ V

REGOLETTA MAGICA (PARALLELO)

$V_{R_P}' = V_{R_2} = V_{R_3}$

$I_{R_3}' = \frac{V_{R_3}}{R_3} = \frac{\frac{60}{13}}{4} = \frac{60}{13} \cdot \frac{1}{4} = \frac{15}{13}$ A

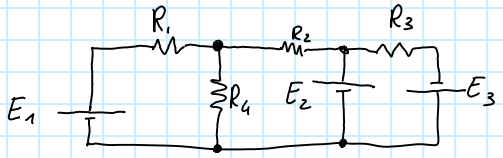
$V_{R_P}'' = R_P' \cdot I_{R_P}'' = \frac{4}{7} \cdot \frac{35}{13} = \frac{20}{13}$ V

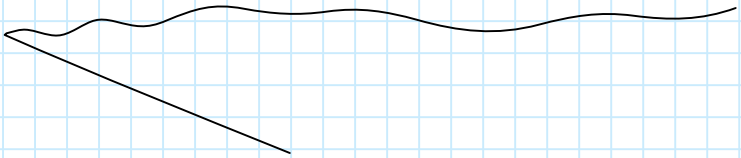
REGOLETTA MAGICA (PARALLELO)

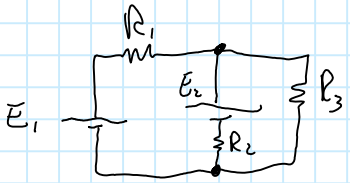
$V_{R_P}'' = V_{R_1} = V_{R_3}$

$I_{R_3}'' = \frac{V_{R_3}}{R_3} = \frac{\frac{20}{13}}{4} = \frac{20}{13} \cdot \frac{1}{4} = \frac{5}{13}$ A

$I_{R_3} = I_{R_3}' - I_{R_3}'' = \frac{15}{13} - \frac{5}{13} = \frac{10}{13}$ A



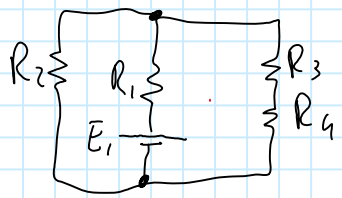




$E_1 = 6$ V $\quad R_1 = 3\ \Omega$ $\quad I_{R_3} = ?$

$E_2 = 10$ V $\quad R_2 = 4\ \Omega$ $\quad V_{R_3} = ?$

$R_3 = 6\ \Omega$



$E_1 = 12$ V $\quad R_1 = 6\ \Omega$ $\quad R_4 = 10\ \Omega$ $\quad V_{R_4} = ?$

$R_1 = 10\ \Omega$ $\quad R_3 = 3\ \Omega$ $\quad I_{R_4} = ?$