Solution

It is easy to remark that after removing the left part of the network, shown in Fig. 4 with the dotted square, then we receive a network that is identical with the initial network (it is result of the fact that the network is infinite).

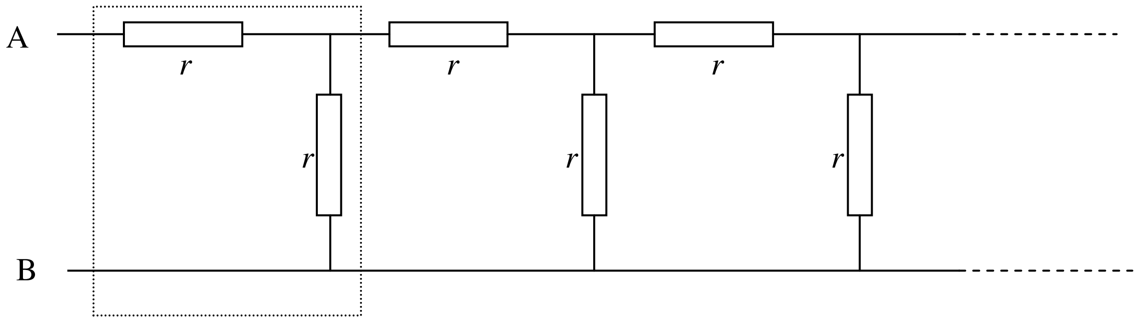

Fig. 4

Thus, we may use the equivalence shown graphically in Fig. 5.

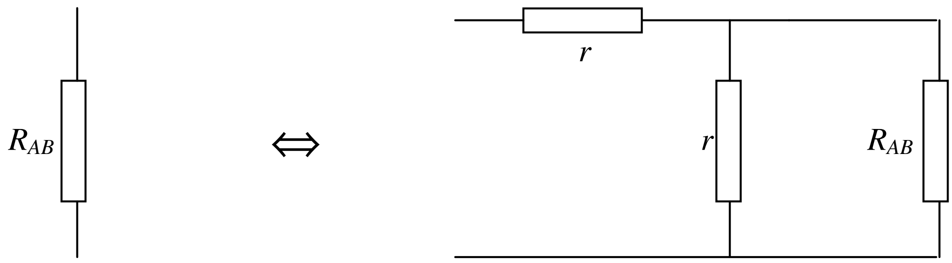

Fig. 5

Algebraically this equivalence can be written as

$$R_{AB} = r + \frac{1}{\frac{1}{r} + \frac{1}{R_{AB}}}.$$

Thus

$$R_{AB}^2 - rR_{AB} - r^2 = 0.$$

This equation has two solutions:

$$R_{AB} = \tfrac{1}{2}(1 \pm \sqrt{5})r.$$

The solution corresponding to “-“ in the above formula is negative, while resistance must be positive. So, we reject it. Finally we receive

$$R_{AB} = \tfrac{1}{2}(1 + \sqrt{5})r.$$