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The condenser principle and the effective resistance on a network

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ABSTRACT

In this work, we prove that the *condenser principle* is satisfied on any resistive network, $\Gamma = (V, E, c)$. This is due to the fact that a condenser problem is equivalent to a suitable Dirichlet problem with constant date on the condenser's plates. Moreover, the solutions of the condenser problems can be obtained by means of equilibrium measures with respect to the laplacian kernel. Taking in mind that the *effective resistance* between the plates of a condenser is defined as the energy of the solution of the condenser problem, we get its expression in terms of equilibrium measures. In particular, the formula for the effective resistance between any pair of vertices of a network is $r_{xy} = \frac{1}{n}(\nu_x(y) + \nu_y(x))$, where ν_z denotes the equilibrium measure for the set $V - \{z\}$.

Keywords: *condenser, effective resistance, equilibrium measure*

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