A central limit theorem for the effective conductance and resistance

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In a rather broad sense, the effective conductance is the minimum value of the Dirichlet energy on a bounded domain subject to a given (Dirichlet or mixed Dirichlet-Neumann) boundary condition. An interesting question in homogenization theory is to characterize this value when the underlying elliptic operator has random coefficients. It is well known that, for stationary and ergodic coefficients, the (normalized) effective conductance in a sequence of scaled domains tends to a non-random value. A natural next question is thus the size, and the asymptotic distribution, of the fluctuations. I will address this question in the context of the random conductance model with i.i.d. coefficients. In particular, I will show that in this case the effective conductance obeys a central limit theorem.

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