Rethinking Dimensional Regularization in Critical Phenomena

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We show that it is possible to use dimensional regularization (DR) beyond the ε-expansion in the context of RG calculations of critical properties. Based on this fact we propose a new functional RG scheme – *Functional Dimensional Regularization* (FDR) – and apply it to a scalar theory in three dimensions. We compute the critical exponents of the `Ising` universality class directly in $d = 3$ under various typical approximations. The method that emerges combines the "agility" typical of DR with the "applicability" and "generality" proper of functional RG. Moreover, FDR usually furnishes – at given order of approximation – faster convergence and better estimates compared to the other functional RGs.