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Global Fixed Points of Scalar and Fermionic Theories

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Interacting fixed points in three dimensions have been investigated using modern renormalisation group methods. Investigations focus on the seminal Wilson-Fisher fixed point solution in O(N) symmetric scalar theories and asymptotically safe UV fixed points in fermionic Gross-Neveu models. The main novelty of the study is the use of Padé approximants. Padé approximants have been used to extend local fixed point data that is obtained from polynomial expansions and hence, only valid for small field values to global fixed point solutions for all field values. For both the scalar and fermionic theories this approach is tested in the Large N limit where explicit analytic fixed point solutions can be found. Particular emphasis is put on the large real field and the large imaginary field limits, and converging-limiting singularities in the complex field plane. Finite N models have also been tested for the O(N) symmetric scalar theories. Here exact solutions are not accessible and Padé approximants have been used to make predictions beyond the radius of convergence of polynomial expansions. Padé approximants have also been used to locate singularities exhibited by the given complexified fixed point solutions. In doing this it is seen that the singularities exhibited by Padé approximants themselves form patterns of defects in the complexified field plane that are intimately linked to their ability to converge to high accuracy.

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