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Continuous wavelet transform in quantum field theory

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We describe the application of the continuous wavelet transform to calculation of the Green functions in quantum field theory: scalar ϕ^4 theory, quantum electrodynamics, quantum chromodynamics. The method of continuous wavelet transform in quantum field theory presented in [1,2] consists in substitution of the local fields $\phi(x)$ by those dependent on both the position x and the resolution a. The substitution of the action $S[\phi(x)]$ by the action $S[\phi_a(x)]$ makes the local theory into nonlocal one, and implies the causality conditions related to the scale a, the *region causality* [2]. These conditions make the Green functions $G(x_1,a_1,\ldots,x_n,a_n) = \langle \phi_{a_1}(x_1)\ldots\phi_{a_n}(x_n)\rangle$ finite for any given set of regions by means of an effective cutoff scale $A = \min(a_1,\ldots,a_n)$.

References

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