

Gamma5 in the non-anticommuting BMHV scheme - restoring gauge invariance at the multi-loop level

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We pursue a no-compromise approach to the gamma5 problem of dimensional regularization. gamma5 is treated in the 't Hooft/Veltman/Breitenlohner/Maison scheme, which is mathematically rigorous but which breaks gauge invariance. As a result, a correct renormalization procedure based on this scheme involves three specific kinds of counterterms: cancelling UV singularities requires (1) counterterms which do not correspond to field or parameter renormalization, (2) evanescent counterterms, and (3) the breaking of gauge invariance necessitates finite symmetry-restoring counterterms. We determine the full structure of all these counterterms at the two-loop level, focusing on the example of a chiral abelian gauge theory. We explain the methodology, which is based on the quantum action principle and a direct computation of the breaking of Slavnov-Taylor identities, and we provide illustrations and checks based on well-known Ward identities.

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