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Automated evaluation of Feynman integrals using GKZ hypergeometric systems

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Feynman integrals at any order of perturbation, in the Lee-Pomeransky representation, could be realised as a subset of Euler-Mellin integrals. Such integrals are known to satisfy the Gelfand-Kapranov-Zelevinsky (GKZ) system of partial differential equations. In an ongoing collaboration, we automate the derivation of the associated GKZ-system for a given Feynman diagram from either its Lee-Pomeransky representation or its Mellin-Barnes representation. We also present the automation of two mathematically equivalent techniques, namely the Gröbner deformation method and the method of triangulations of point configurations to solve this system, in the form of Mathematica packages, with support from specialised software such as TOPCOM, Polymake, and Macaulay2. As applications, we show that our package allows one to compute both NLO and NNLO Feynman integrals and express their result as multivariate hypergeometric functions.

Session

Formal Theory

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