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Frobenius solution for non-polylogarithmic Feynman integrals and hypergeometry expansion

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The analytical calculation of Feynman integrals is an important problem in modern quantum field theory. This task is important both for obtaining the most accurate predictions for observable quantities and for some areas of pure mathematics such as theory of periods in algebraic geometry. Nevertheless, it is not always possible to obtain analytical solutions for all Feynman integrals beyond one loop. All difficulties are usually associated with the appearance of elliptic or more complex geometric structures which inevitably arise when taking into account the masses of propagators.
In this work, we use an example of two loop elliptic master integrals arising from non-relativistic QCD as a laboratory to develop new methods for calculating non-polylogarithmic Feynman integrals. Specifically, the Frobenius method will be considered, which allows in this case to obtain exact solutions, in terms of the dimensional regularization parameter. In this case, the solutions will be expressed in terms of generalized hypergeometric series. In the second part of the report, we will focus on specific generalized hypergeometric functions present in the solution. Their expansion in terms of the dimensional regularization parameter will be considered. In this case, it is possible to obtain both integral representations and representations in the form of triangular sums.

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