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Status of two-loop automation in OpenLoops

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The development of a fully automated tool for the numerical calculation
of NNLO corrections to scattering amplitudes is a highly desirable goal for the LHC era.
In our approach, D-dimensional two-loop amplitudes are decomposed into Feynman integrals with four-dimensional numerators as well as (D-4)-dimensional remainders, which can contribute to the finite result through the interaction with the poles of Feynman integrals.
The integrals with four-dimensional numerators are then expressed as tensor integrals in the loop momenta contracted with tensor coefficients.
Hence, the calculation can be structured into the computation of the tensor coefficients, the treatment of (D-4)-dimensional numerator parts, the renormalisation procedure, and the reduction and evaluation of the tensor integrals.

In this talk, we present the status of OpenLoops with respect to these building blocks.
A highly efficient algorithm for the construction of the tensor coefficients has been developed and fully implemented for QED and QCD corrections to the SM. Recently, the renormalisation procedure as well as the reconstruction of the interplay of (D-4)-dimensional numerator parts with UV poles through two-loop rational counterterms has been implemented and validated. In order to test this framework we implemented an in-house library for the reduction of simple tensor integrals. This is currently being used to reproduce first two-loop amplitudes for simple processes with off-shell particles, which constitute the first application of the concept of two-loop rational terms of UV origin. Finally, we give an outlook on the current and nexts steps towards the automation of two-loop calculations in OpenLoops.

Author: ZOLLER, Max (UZH / PSI)

Presenter: ZOLLER, Max (UZH / PSI)

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