Contribution ID: **26**   Type: **not specified**

On the evaluation of two-loop electroweak box diagrams for e+ e- to HZ production

Saturday, 31 October 2020 05:00 (1 hour)

Precision studies of the Higgs boson at future e+e- colliders can help to shed light on fundamental questions related to electroweak symmetry breaking, baryogenesis, the hierarchy problem, and dark matter. The main production process, e+ e- to HZ, will need to be controlled with sub-percent precision, which requires the inclusion of next-to-next-to-leading order (NNLO) electroweak corrections. The most challenging class of diagrams are planar and non-planar double-box topologies with multiple massive propagators in the loops. We generate a new technique for computing these diagrams numerically, by transforming one of the sub-loops through the use of Feynman parameters and a dispersion relation, while standard one-loop formulae can be used for the other sub-loop. This approach can be extended to deal with tensor integrals. The resulting numerical integrals can be evaluated in minutes on a single CPU core, to achieve about 0.1% relative precision.

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Session Classification: 数值计算