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

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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 electroweak (NNLO) corrections. The most challenging class of diagrams are planar and non-planar double-box topologies with multiple massive propagators in the loops. This article proposes a 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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