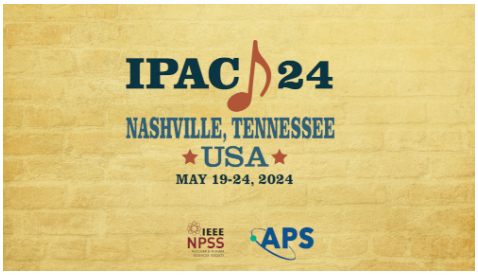

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Adjoint approach to the design of vacuum RF sources

Tuesday, 21 May 2024 16:00 (2 hours)

Efficient calculation of multi-dimensional derivatives of various performance metrics of RF sources with respect to different design parameters is a critical element of their optimization and sensitivity analysis. The direct approach is to change slightly the value of a design parameter of interest and compute the resulting change in the metric of interest; an example is a calculation of how a small change in klystron cavity spacing affect output power. The major problem with this approach is a number of required runs of a simulation code. For example, when there are many (N) design parameters of interest then (N+1) runs are required. N can be very large for detailed design of RF sources for accelerators [,]. *By computing the solution of the adjoint of the perturbed equations for the beam-wave interaction, we have shown* [**] that all N partial derivatives may be computed with only three runs of the simulation code, no matter how large (N) is. Once calculated, these partial derivatives may be used to specify manufacturing tolerances and/or used in a design optimization calculation. We will also present examples of applications of adjoint approach to klystron and TWT design.

Footnotes

[] *G. Cariotakis, IEEE Trans. on P.S, 22, 693-691, 1994*
[] *A.Y. Baykov, et al., IEEE Trans. on ED, 62, 3406-3412, 2015*
[**] A.N. Vlasov, et al., IEEE Trans. PS, 50, 2568-2577, 2022

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