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# Using supervised machine learning in power converters design for particle accelerators – application to magnetic components design

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Volume and precision are tightly related to magnetic components that are typically necessary in a power converter for filtering (inductor) or voltage adaptation (transformer) purposes.

This paper presents a methodology for creating an efficient design tool for magnetic components to be used in power electronics applications. Specifically, an air cored inductor is taken as an example. The method consists in using supervised machine learning to create a magnetic and an electrodynamics model, able to predict the inductance value and mechanical efforts on the winging, depending on dimensional input variables. The ANN model can predict the inductance value and is trained via Finite Element Analyses (FEA). Furthermore, it can predict the electrodynamic efforts in the winding, to prevent deformation (in relation to the power converter' s output current precision) or minimise acoustic noise emission.

The ANN-based model is then included into an optimisation process, where the input variables (dimensions) are selected in order to minimize the volume or the mass of the inductor and respect some constraints such as the desired inductance value or deformation constraints. This means that the ANN model is evaluated many times before finding an optimal solution. In this context we demonstrate the power of an ANN model, where the computation time is reduced by 60 times compared to a FEA approach.

## Funding Agency

## Footnotes

## I have read and accept the Privacy Policy Statement

Yes

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