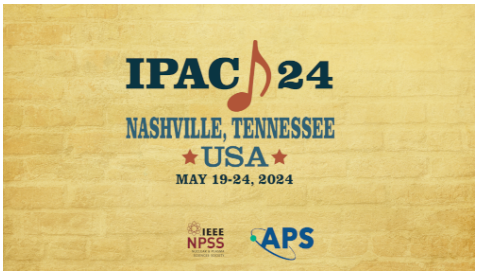

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Advancing non-linear Space Charge Simulations: Neural Networks and Analytical Approaches

Sunday, 19 May 2024 16:00 (2 hours)

This study introduces a convolutional encoder-decoder architecture inspired by the skip connections used in ResNets, designed for predicting the transversal E-field. It has demonstrated impressive initial results, achieving a mean squared error (MSE) of 0.0054, which further improves to 10^{-7} within just a few minutes of training. These results establish a strong foundation for advancing to 3D space charge simulations. Additionally, the potential of replacing traditional ellipsoidal methods with Gaussian envelope models for nonlinear space-charge calculations is explored, thereby potentially enhancing the accuracy of simulations. In parallel, polynomial neural networks are investigated alongside CNNs, aiming to accurately model both external and self-fields using simulation and measurement data, respectively.

Footnotes

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