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RF cavity wakefield calculation based on neural network algorithm

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The interaction of the beam with the accelerating structure induces electromagnetic fields within the structure, commonly referred to as wakefields, which exists within the accelerating structure and alter the original electromagnetic field distribution and in turn affects the beam. Such effects are often undesirable, in storage rings, wakefields excited by the bunch can induce single-bunch Robinson instability, which is related to the presence of higher-order modes in the radiofrequency cavity. In an ideal scenario, the calculation of wakefields must ensure sufficient tracking time or length to guarantee the complete decay of the wake potential. In some high-Q RF structures, the computational time for wakefield calculations can be extremely long. This paper proposes a computational method utilizing neural networks, which, by training the neural network with a shorter truncated length, can calculate the wakefields under the equilibrium state of the wake potential, effectively improving the computational efficiency of wakefields in RF cavities.

Footnotes

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