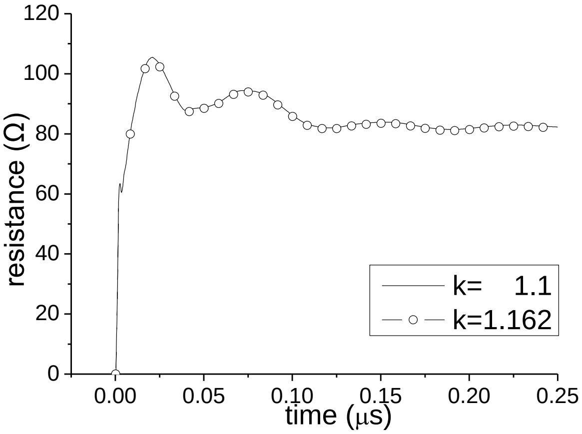

Fig.6. The E_z variation in the z direction near the angle iron.

Firstly, a 6 cm×6 cm×250 cm earthing conductor is involved. The electric and magnetic field components 2 cm away from the conductor are monitored, as shown in Fig.3 and Fig.4 respectively. It can be seen that the proposed method simulates the electromagnetic filed components accurately.

The resistance of the grounding system is also calculated, as graphed in Fig.5. It can be seen that the proposed model is an accurate modeling of the grounding system resistance.

Secondly, we also tested the proposed method performance when the expansion factor *k* the grounding resistance of another 1.5 m long angle iron. The expansion factor is *k*=1.1 and *k*=1.162 respectively, and the grounding resistance is plotted in Fig.6. It can be seen that the result given by the two conditions are in good agreement with each other.

Form the validation of the electromagnetic field components and the grounding resistance of two earthing conductors, the efficiency of the proposed method is validated. However, the memory usage of the proposed method is 52 MB, while the standard FDTD simulation occupied 1.8 GB memory.

V. Conclusion

In this work, non-uniform grid in the FDTD methods, which is typically used to resolve fine structures, is introduced into reduce the computational domain and therefore lead to a reduction of the computational cost. To further reduce the computational memory, the uniform grids are used in the electrode length direction while non-uniform grids are occupied in the electrode sectional directions.

The accuracy of the proposed method has been approved from the validation of the electromagnetic field components and the grounding resistance result. It is demonstrated that the much computational memory is saved when the proposed method is used compared with the standard fine grid FDTD simulation.

With the proposed method, the earthing conductor of the grounding systems in the grounding resistance analysis can be modeled without involving huge computational resources.

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