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IMPULSE IMPEDANCE OF A LONG LINEAR GROUND IN NON LINEAR SOIL

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ABSTRACT
What is presented in this work is the influence of a specific soil resistance as well as the influence of soil nonlinearity on a response of a long linear ground to impulse inputs. Current deployment along the ground is shown and the results of the impulse impedance estimate are presented. Possible errors in case of nonlinearity disregarding are also highlighted.
Keywords: Impulse impedance, non linear soil, linear ground

1. INTRODUCTION
Ground response to impulse inputs differs significantly from the response of direct current stationary states inputs and industrial frequency current inputs. Impulse impedance can be lower or higher than transient resistance of stationary state depending on the slope and the entry impulse intensity. In practice, impulse coefficient is used to show this.
Apart from the mentioned factors, impulse impedance is also influenced by nonlinearity of the ground environment. In this work, the influence of environment nonlinearity on ground response in impulse regimes is analysed.

2. CURRENT DEPLOYMENT ON THE GROUND
There are different approaches in impulse impedance estimates for long linear horizontal grounds in lenear environments [1,2,4].
In nonlinear environments electric field intensity is given in the following relation

$$E = A \cdot J^{\beta} \tag{1}$$

where A - coefficient of variation and β – nonlinearity coefficient.
In linear soils $A=\rho$ and $\beta=1$.
In [2 and 5] the deployment of impulse current along a long ground is analysed and what we have is a simple relation for current deployment (2):

$$i(x,t) = \frac{at}{\ell} + aL\ell g\left(\frac{1}{3} - \frac{x}{\ell} + \frac{x^2}{2\ell^2}\right) \tag{2}$$

where α – slope of input impulse head, ℓ – length of the ground, L – inductivity and g – ground conductivity.
The current expression (2) can be used for calculating impulse impedances in nonlinear environments.The method of iterative apporoaching can be applied. As a zero iteration we can take the absence of nonlinear processes in the soil, according to which the current deployment along the ground is calculated. Based on this deployment, we get the fictitious radius of spark zone and nonlinearity zone. As the first iteration for nonlinear radius, at the spot of current entry on the ground, the impulse impedance is determined.