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A Generalized Approach to Deduce the Wave Parameters of High-Voltage Single-Core Power Cables

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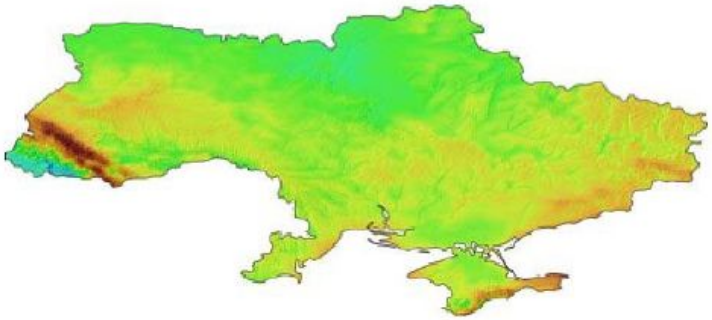
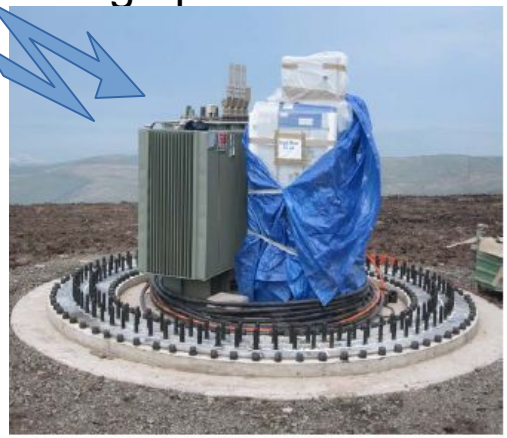
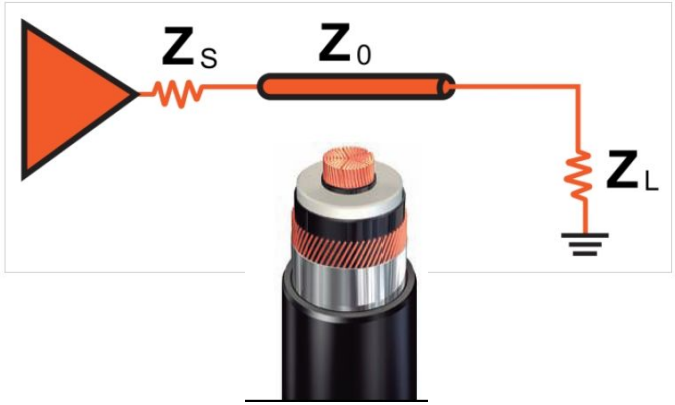
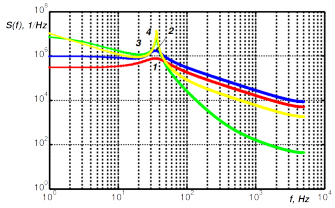
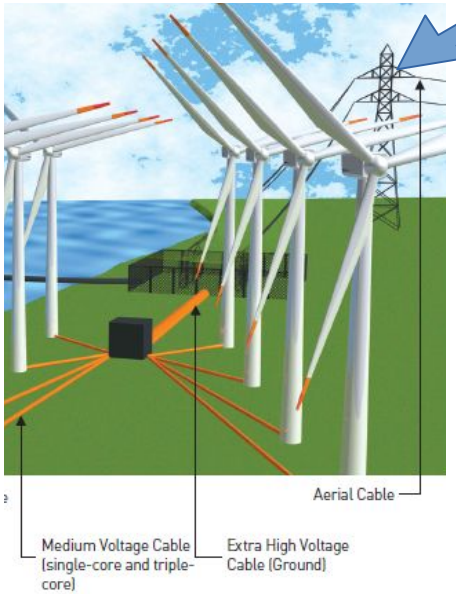


The purpose of this study is to develop a methodology for determining wave parameters: impedance, propagation coefficient (coefficients of attenuation and phase factor), based on the determination of active resistance, inductance, capacitance, and active insulation conductivity (dielectric loss tangent) of high-voltage power cables of coaxial design with a single core.









CONCLUSION

1. A generalized methodology for determining the wave parameters of single-core high-voltage power cables based on the determination of resistance, inductance, electrical capacity, and insulation conductivity in a wide frequency range is presented.
2. The numerical calculation of the resistance and inductance is determined taking into account the skin effect and the effect of the proximity of the magnetically connected circuits of the conductive core and the metal screen.
3. The electrical capacity, tangent of the dielectric loss and conductivity of the three-layer composite system, which includes semiconductor screens on the core and insulation and the cross-linked polyethylene insulation itself, are determined taking into account the electro-physical properties of the components and their thickness.
4. Thus, wave impedance is an individual characteristic of a power cable and depends on the material and cross-section of the conductive core and metal screen, electro-physical properties of semiconductor screens and insulation and its thickness.
5. The tangent of the dielectric loss significantly affects the attenuation coefficient of electromagnetic energy, especially in the high-frequency range in power cables even of the same voltage class.
6. This requires the creation of a suitable database on the electro-physical characteristics and thickness of semiconductor shields of power cables from manufacturers.
7. The proposed technique is of great practical importance for determining wave parameters and entering the values of wave impedance and attenuation coefficient of the corresponding frequency range, depending on the design and the materials used by the manufacturer, into the technical parameters of high-voltage power cables.

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Thank you for attention!