Data Article

Data on the interference induced on a buried pipeline by an overhead power line

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ARTICLE INFO

ABSTRACT

The data presented in this article relate to the research article "A quasi-3D approach for the assessment of induced AC interference on buried metallic pipelines" (Popoli et al., 2018) [1]. The current induced on a pipeline versus the distance between the overhead power line and the pipeline is presented. Various configurations of the overhead power line are considered. The calculations are based on method that combines 2D FEM simulations with circuital analysis.

Specifications table

Subject area	*Electrical engineering*
More specific subject area	*Power system/Corrosion/Electromagnetic interference*
Type of data	*Tables and figures*
How data was acquired	*Numerical simulation*
Data format	*Raw and analyzed*
Experimental factors	*No pretreatment of data was performed*
Experimental features	*The simulation of the coupling between the overhead power line and the buried pipeline was carried out using a proprietary software tool*
Data source location	*University of Bologna, Bologna, Italy*

Value of the data

- The data are valuable for the assessment of the electromagnetic interference generated by various configurations of overhead power lines on buried metallic pipelines.
- The data regarding the induced current on the pipeline are presented as a function of the distance of the overhead power line from the pipeline.
- The data are useful to other researchers to individuate the positions of the pipeline that should be avoided in order to limit the current on the pipeline.
- The data accompanying this article in the form of matrices extracted through 2D FEM analysis can be used to perform further studies with different currents and voltages and circuital configurations.

1. Data

The data reported in this paper refer to the electromagnetic interference between overhead power lines and buried metallic pipelines sharing the same corridor.

Data consist of the current induced on a pipeline by an overhead power line for five configurations (A, B, C, D, E) of the power line. A balanced three-phase system of currents $\hat{I}_1 = 778e^{j0}$, $\hat{I}_2 = 778\,e^{-j2\pi/3}$, $\hat{I}_3 = 778\,e^{-j4\pi/3}$ was enforced on the phase conductors. The pipeline-to-soil grounding resistance was set to 5Ω. They also concern the validation of the calculation procedure proposed in Ref. [1]. The data relevant to each configuration results from a circuital elaboration of a representative matrix, extracted with the 2D FEM code described in Ref. [1]. These matrices accompany this paper in *MATLAB/OCTAVE* format and are labelled according to the configuration they are representative of. As an example, the configuration A shows 7 conductors (including the soil) and has been computed for 15 different horizontal distances of the pipeline. Hence, the *current_matrix_conf_A* file contains a 7x7x15 matrix, where each 7x7 submatrix [M] refers to a specific horizontal distance of the pipeline, detailed in file *horiz_pipe_distances_A*. Each submatrix [M] embodies the electrical relation between the conductors of the discretized configuration, and hence can be used to obtain the current on each conductor given their longitudinal voltage and length $\{I\} = [M]\{\sigma\}\{V_0\}/L$, or vice versa. The detailed instructions on the usage of the data are given in the provided *readme.txt* file.

2. Experimental design, materials, and methods

Details of the calculation method are presented in Popoli et al. [1]. The method combines a 2D FEM approach with circuital analysis in order to provide a 3D solution to the problem with a reduced computational effort in comparison with full 3D analysis methods and without introducing the weak coupling assumption typical of the analytical approaches. The current induced on the pipeline was calculated versus the distance between the overhead power line and the pipeline. The configurations of the overhead power lines considered were chosen among typical ones in electric power distribution and are summarized in Fig. 1 (labelled with letters from 'A' to 'E'). In Figs. 2–6 the currents induced on the pipeline for the overhead power lines in configurations 'A' to 'E' are shown, respectively, versus the distance between the center of the power line and pipeline. From Figs. 2–6 the distances at which the induced current is maximum (and thus the electromagnetic coupling) can be easily individuated.

The calculations can be easily extended to take into account different overhead power line configurations and distances of the pipeline, as well as depths of the pipeline.

In order to assess the effect of the power line configuration on the current induced on the buried metallic pipeline, a comparison among the 'A', 'B' and 'C' configurations of the overhead power line is shown in Fig. 7.
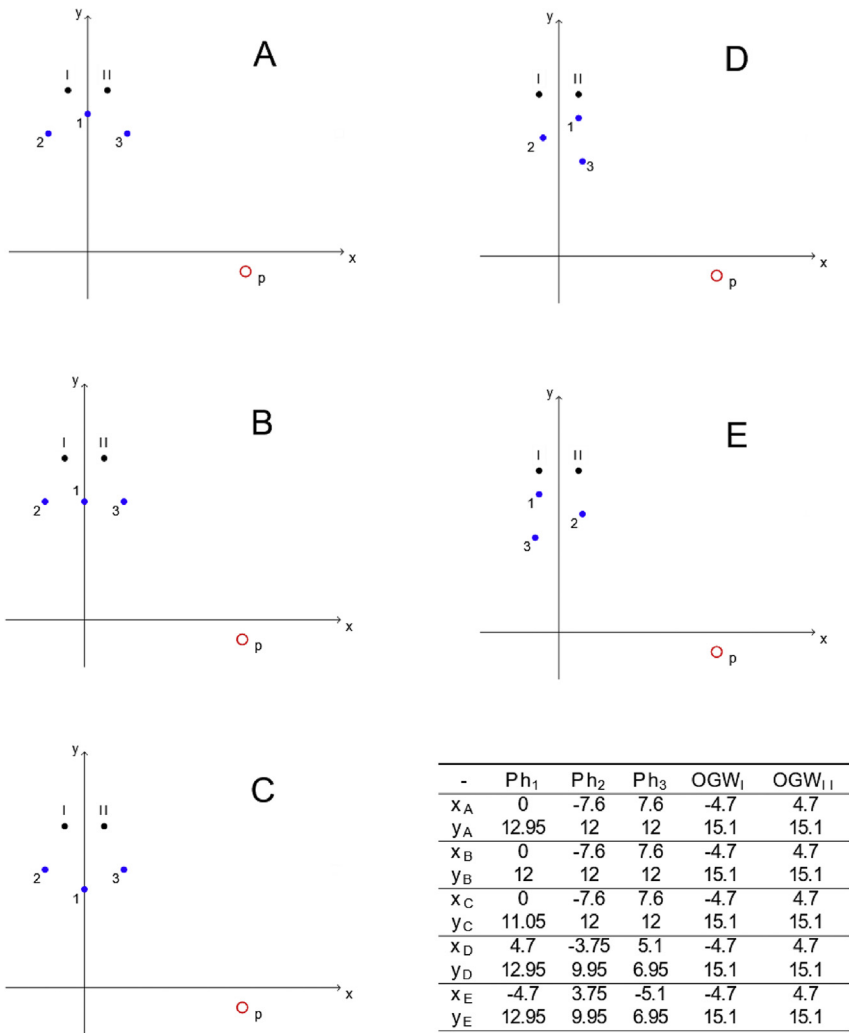
-	Ph₁	Ph₂	Ph₃	OGW₁	OGW₁₁
x_A	0	-7.6	7.6	-4.7	4.7
y_A	12.95	12	12	15.1	15.1
x_B	0	-7.6	7.6	-4.7	4.7
y_B	12	12	12	15.1	15.1
x_C	0	-7.6	7.6	-4.7	4.7
y_C	11.05	12	12	15.1	15.1
x_D	4.7	-3.75	5.1	-4.7	4.7
y_D	12.95	9.95	6.95	15.1	15.1
x_E	-4.7	3.75	-5.1	-4.7	4.7
y_E	12.95	9.95	6.95	15.1	15.1

Fig. 1. Configurations considered for the assessment of the electromagnetic coupling between overhead power lines and a metallic pipeline buried 1.5 m in the soil.
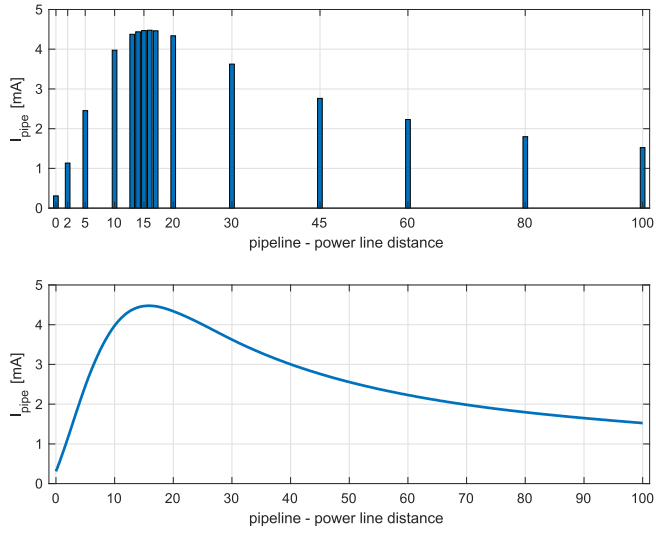
Fig. 2. Current induced on a buried metallic pipeline by the 'A' configuration of the overhead power line.
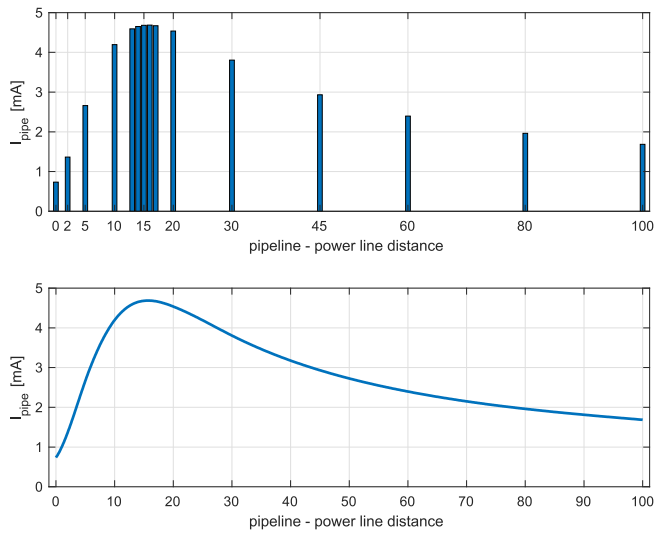

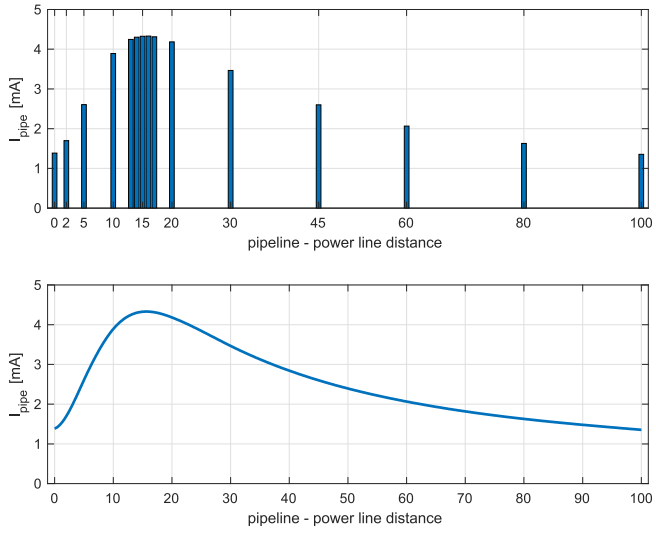**Fig. 3.** Current induced on a buried metallic pipeline by the 'B' configuration of the overhead power line.

Fig. 4. Current induced on a buried metallic pipeline by the 'C' configuration of the overhead power line.
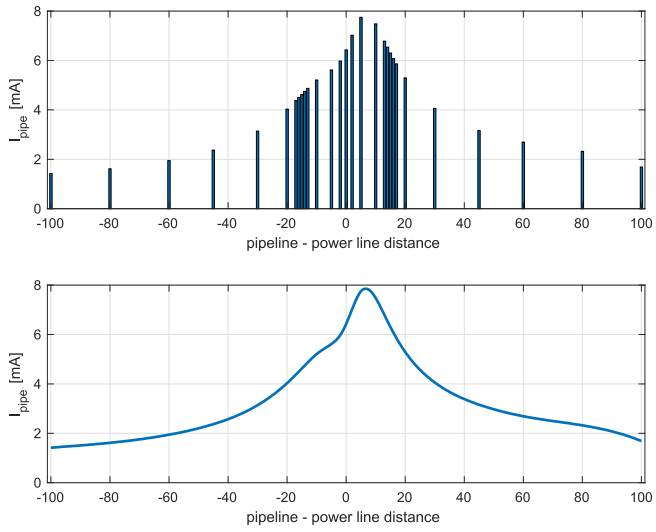

Fig. 5. Current induced on a buried metallic pipeline by the 'D' configuration of the overhead power line.
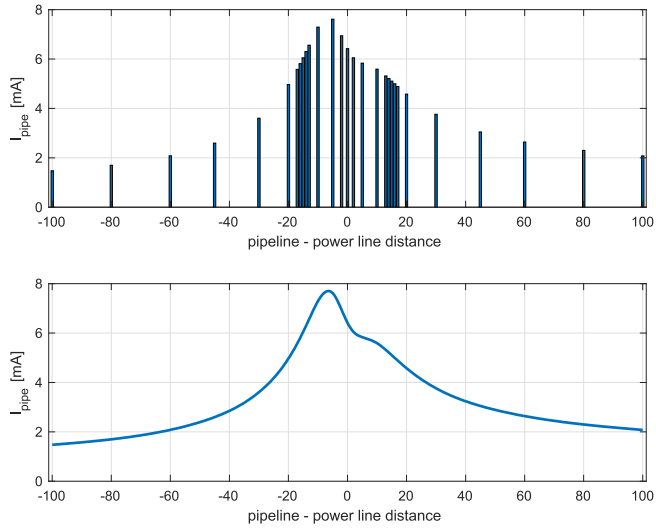
Fig. 6. Current induced on a buried metallic pipeline by the 'E' configuration of the overhead power line.
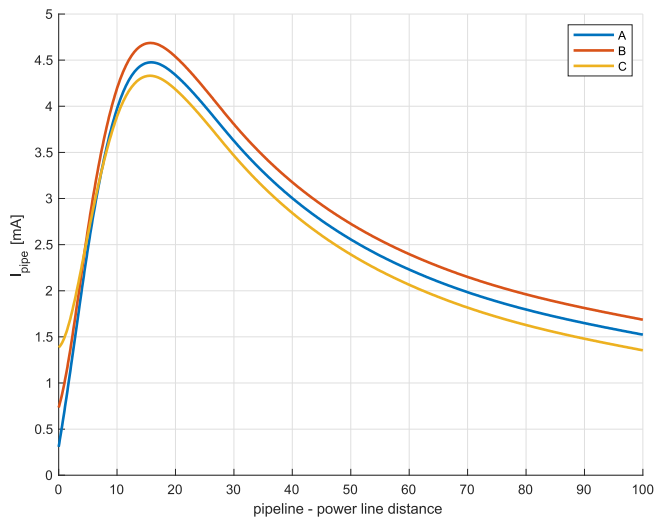

Fig. 7. Comparison of the current induced on a buried metallic pipeline generated by the 'A', 'B' and 'C' configurations of the overhead power line.

Transparency document

Transparency document associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2019.103776.

Reference

[1] Arturo Popoli, Leonardo Sandrolini, Andrea Cristofolini, A quasi-3D approach for the assessment of induced AC interference on buried metallic pipelines, Int. J. Electr. Power Energy Syst. 106 (2019) 538–545, https://doi.org/10.1016/j.ijepes.2018.10.033. ISSN 0142-0615.