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## On the anniversary of the fruitful idea (a reply to comments by A V Guglielmi)

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The fact that in 2009 two leading Russian physical journals published articles [1, 5] devoted to the Leontovich boundary condition testifies to the fact that we are dealing with an exclusively successful heuristic idea. The present polemics following publication of Refs [1, 5] continue celebrating the 70th anniversary of the idea.

## References

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The aim of our work [1], which caused the polemical comments by A V Guglielmi, not only reduced to a discussion of the generalization of the Leontovich boundary condition for electromagnetic fields in the form of the exact equation that is valid for all surface impedances  $\zeta$  of a metal. It was demonstrated in Ref. [1] that ordinarily the Leontovich approximation surprisingly works perfectly without any correction. If it fails, as in the case of the electromagnetic wave reflection from a metal surface at angles close to the sliding incidence, then a single correction would not be sufficient. This is the very case in which our exact formula would be useful.

The fact that the corrections to the classical Leontovich formula start with a term cubic in impedance ( $\zeta^3$ ) is well known from the literature; see the reference to monograph [2] in our article [1]. The study by Rytov [3] also illustrates this fact. The study was discussed in detail by Leontovich himself in the article first published in 1948 and then in 1985 in his collected papers [4] (see Ref. [1] in our article). The discussion of Rytov's results proves that Leontovich was indeed aware of the problem of corrections to the boundary condition and knew very well that the first correction to the classical formula is  $\sim \zeta^3$ . This fact is not questioned in Ref [1]. In contrast to the declaration by Guglielmi, we do not assert that Leontovich underestimated the "accuracy of the boundary condition." It is quite a different question of how accurately the particular characteristics of wave fields can be calculated applying the classical Leontovich formula.

Discussing the underestimation of the accuracy in Ref. [4], we meant the results obtained via the boundary condition rather than the condition itself. Here, Leontovich actually underestimated the accuracy of his own approximation. At the end of Ref. [4] he compares the reflection coefficient for a plane wave obtained in the impedance approximation with the exact Fresnel solution. He asserts that the difference corresponds to the error that is quadratic in impedance. Nevertheless, with a more thorough comparison one can see that this difference is cubic in impedance — that is, the result is more precise. This is what we say in our article [1, pp. 867-

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Received 16 September 2009 Uspekhi Fizicheskikh Nauk 180 (1) 106 (2010) DOI: 10.3367/UFNr.0180.201001h.0106 Translated by N A Raspopov; edited by A Radzig 868] after the sentence cited by Guglielmi. The mentioned portion of text on the whole has an unambiguous sense and can hardly be interpreted in another way by a reader. This also relates to the Abstract to our article, in which, judging

from the reaction by Guglielmi, we were not clear enough.