Preface.

The development of the Eddy Current method, has been accompanied in the years with the publication of specific texts, some of them being well known to the "introduced people", in which very often the arguments are treated with graphs and descriptions about the operative tecniques, introducing, whenever necessary, some formalisms and parameters of the theory, without rendering the texts heavy with proofs and theorical implications; that being, on the other hand, the main need of the operative User.

Some other texts, of higher level, develop and discuss the theory of Eddy Current from a merely analytical point of view, starting from positions too far away from the non destructive people realm, aiming to treat the theory from an aprioristic point of view. Moreover, the various arguments (theory of Eddy Current related to: encircling coils, internal coils, probe coils etc.) are often treated in separated texts, without didactic connection among them. Consequently, the reader may face with some difficulty in recepting the whole concepts in a homogeneous frame.

Such a situation was perceived by the writer in the years devoted to NDT applications. Specially with regard to propedeutic programs of qualification for personnel at level 3 in the Eddy Current method, where the lessons on theory may sometimes be not fully developed in a unitary frame because of the not homogeneous school curricula of candidates. On the other hand, even for a self-taught man, willing to treat this hard matter, it could be almost difficult finding in bibliography a suitable analytical approach to basic principles of Eddy Current, without facing with complex texts, rather extraneous to the operative NDT realm.

Considering such situation, the basic premise of the Author was to offer to the Reader a homogeneous text not too heavy and capable of improving his knowledge to a higher level with respect to the one usually required in current practices.

In principle, the main attention was not dedicated to particular operative tecniques, as, in general, they may be directly obtained by experimental way and, on the other hand, would hardly be advantageous for the Reader in the present context.

On purpose, the presentation of arguments was kept like an exercise lecture, with reasonably accessible analytical developments. Moreover, several arguments were treated within a same organic didactic frame, also with crossed comparison about arguments that in general may be found in different texts of bigger size. These are for example the cases for the cylindric geometry theory, requiring the development of particular solutions by means of Bessel's equation and the surface probe coil theory, leading to an analytical development, based on the plane electromagnetic wave.

Particular emphasis has been given, at first, to the thin cylindric layer theory, as it allows to obtain interesting results with simple analytical instruments (like the symbol method, well known in Electrotechnique). Such an approach, in fact, makes it possible to define and introduce by simple passages the main parameters of Eddy Current theory, as well the Similitude Principle, useful for the comprehension of several paragraphs dedicated to the cylindric geometry.

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