

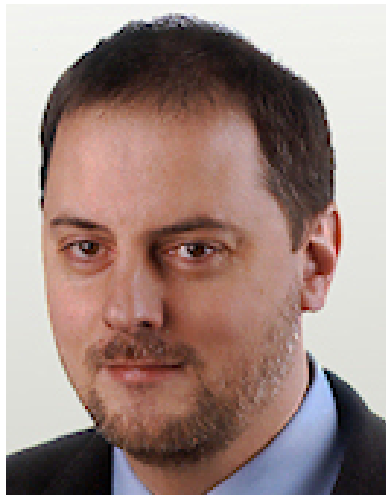
On the Use of Hypercomplex Numbers for Antenna and Propagation Problems

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There are several possible generalizations of complex numbers, collectively referred to as hypercomplex numbers. Quaternions, which are widely used e.g. for the description of rotations in three dimensions, are a well known example. In particular, Quaternions, which have a real part and three imaginary units, predated the use of vector calculus, and the vector concept resulted out of a simplification and modification of quaternion algebra. Later, vector calculus mostly superseded the use of quaternions in electromagnetics.

Unlike complex numbers, which are a ubiquitous and indispensable tool in science and engineering, applications of hypercomplex numbers in electrical engineering currently seem to be limited to some special cases. Nevertheless, there are some applications in electromagnetics (e.m.) as well.

The purpose of the presentation is to give an overview on some types of hypercomplex numbers and to stimulate a discussion on their possible uses for e.m. problems. As an application example related to antennas and propagation, the determination of amplitude radiation patterns using the three antenna method is discussed. It is shown how a formulation in terms of vectors and matrices can be interpreted using hypercomplex numbers.



Biography – Jürgen Kunisch

Jürgen Kunisch received the Dipl.-Ing. degree and the Dr.-Ing. degree in Electrical Engineering from the University of Duisburg, Germany, in 1989 and 1994. Since 1994 he is with IMST GmbH in Kamp-Lintfort, Germany, where he is currently head of the "Wave Propagation and Radar Methods" section.

His working areas include the physical layer of mobile communication and localization systems, and in particular all aspects of radio wave propagation for communications and radar.