Efficient analysis of electromagnetic problem involving large bodies using current modes

Felipe Cátedra*, Carlos Delgado*, Stefano Luceri*, Francisco Saez de Adana*, Fernando Rivas**

**Departamento de Electrónica. EUP de Linares. Universidad de Jaén, SPAIN
*Departamento de Teoría de la Señal y Comunicaciones.
Universidad de Alcalá ,28806 Alcalá de Henares (MADRID), SPAIN
Fax: + 34 91 885 66 99, email: felipe.catedra@uah.es

ABSTRACT

It has been shown that the current in large bodies can be efficiently represented by means of current modes, each one of them defined by means of an exponential function which amplitude and exponent change slowly along the smooth areas of the body (Z. Altman, R. Mittra. *IEEE Transactions on Antennas and Propag.*, pp 744-751, April 1999). Recently it has been shown that the amplitude and phase functions of the modes can be interpolated efficiently from a reduced set of sampling points using splines functions like NURBS (Non-Uniform Rational Bi-splines Surfaces), (O. Gutierrez, F. Saez de Adana, F. Rivas, I. Gonzalez, M.F. Cátedra: "Method to interpolate the induced current with a low amount of sample points by means of Bézier surfaces", *Electronics Letters*, to appear. 2003). In this communication a very efficient way to compute the far or near field due to a current mode is presented. In the computation of the integrals that appear in the field evaluation the integrand function is traditionally sampled at a rate in accordance with the Nyquist criterion, say at least twice the maximum spatial frequency, that represents a minimum of four samples per wavelength, although many times a rate of eight or ten samples per wavelength is used. In the approach that will be presented the phase variation of the mode is extracted, reducing by order of magnitude the sampling rate required to compute the integrals. This means an spectacular reduction in the CPU-time evaluating the field. The approaches described can be combined in an iterative approach to find the induced current solving integral equations because the current is represent efficiently using current modes and the iteration between modes are evaluated considering very small and frequency independent sampling rates.