Time-Domain Analysis of Electromagnetic Problems for Nanoscale Objects by Integral Equation Methods with Fast Inverse Laplace Transform

Seiya Kishimoto * (1), Shinichiro Ohnuki (1), Yoshito Ashizawa (1),
Katsuji Nakagawa (1), Shao Ying Huang (2), and Weng Cho Chew (3)
(1) College of Science and Technology, Nihon University,
Tokyo, 101-8308, JAPAN, E-mail: cssi11001@g.nihon-u.ac.jp
(2) Singapore University of Technology and Design, Singapore
(3) University of Illinois, Urbana-Champaign, USA

Abstract

For ultra-fast and ultra-high density magnetic recording, all-optical magnetic recording has attracted attention. This state-of-the-art technology needs circularly polarized light. In this report, we propose a novel computational method to design the plasmonic antennas which generate localized circular polarized light for high-density recording. We will discuss characteristics of the antenna in terms of the time response of electromagnetic fields and Stokes parameters.

Our proposed method is based on the combination of integral equation methods and fast inverse Laplace transform (FILT). The integral equation method, the boundary integral equation method (BIEM) using the static approximation or Poggio-Miller-Chang-Harrigton-Wu-Tsai (PMCHWT) method, is considered and extended in the complex frequency. The electromagnetic fields in the complex frequency domain can be obtained by the integral equation methods and transformed into the time-domain by using fast inverse Laplace transform (FILT). Our method can perform reliable and fast simulation, with the following advantages: (1) the computational error is easy to be controlled; (2) the solution at each observation time can be calculated independently; (3) the time step size can be selected as an arbitrary number; and (4) high parallel efficiency can be obtained.