Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **15 (2008)** 755-768
 http://www.watam.org

FLATLET OBLIQUE MULTIWAVELET FOR SOLVING INTEGRO-DIFFERENTIAL EQUATIONS

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Abstract. In this paper we construct a flatlet biorthogonal multiwavelets System. Then, we use this system for numerical solution of Integro-differential equations. The good properties of this system, i.e., biorthogonality and more vanishing moments lead to efficient and accurate solutions. Some test problems with known solutions are presented and the numerical results are given to show the efficiency of the proposed technique.

Keywords. Integro-differential equations, Flatlet oblique multiwavelets, numerical solution.

AMS (MOS) subject classification: 47H10

1 Introduction

The advantages of multiwavelets and their promising features in applications have attracted a great deal of interest and effort in recent years to extensively study them [3, 4]. As was shown in [5] and [6], multiwavelet basis can be successfully used for representing integral operators. A wide class of integro-differential operators has effectively sparse representations in these basis, due to vanishing moments of the basis functions. There are two main reasons for using wavelet basis as a tool for computing solutions of integro-differential problems. First, the fact that integro-differential equations give rise to difficulties in setting up numerical schemes, since requirements for the descretization of integral and differential operators appear contradictory. In particular, the usual discretizations of integral operator lead to dense matrices. In some works such as [10], representations of operators in bases of multiwavelets, with the goal of developing adaptive solvers for linear and nonlinear partial differential equations, are constructed.
A Biorthogonal Multiwavelet System(BMS) consists of a pair of biorthogonal multiscaling functions and a corresponding pair of multiwavelets. It is known that short support and high vanishing moments are the two most important features of a BMS. We refer the readers to [9] for more information about constructions and samples of BMS. In this paper, we use flatlet multiwavelets with multiplicity m and will present an algebraic tool to extend it to a BMS.