Electronic Transactions on Numerical Analysis.
Volume 39, pp. 22-31, 2012.
Copyright © 2012, Kent State University.
ISSN 1068-9613.

ETNA
Kent State University
http://etna.math.kent.edu

COLLOCATION METHODS BASED ON RADIAL BASIS FUNCTIONS FOR THE COUPLED KLEIN-GORDON-SCHRÖDINGER EQUATIONS*

AHMAD GOLBABAI† AND ALI SAFDARI-VAIGHANI‡

Abstract. This paper presents radial basis function (RBF) collocation methods for the coupled Klein-Gordon-Schrödinger equations. Unlike traditional mesh oriented methods, RBF collocation methods require only a scattered set of nodes in the domain where the solution is approximated. For the RBF collocation method in finite difference mode (RBF-FD), weights for the finite difference formula are obtained by solving local RBF interpolation problems set up around each node in the computational domain. We show that the RBF-FD method has good accuracy and a sparse coefficient matrix, as compared to the global form of the RBF collocation method and other methods.

Key words. Collocation methods, coupled Klein-Gordon-Schrödinger equations, radial basis functions (RBF).

AMS subject classifications. 65N06, 65N40, 65D25, 35Q51.

*Received February 9, 2011. Accepted January 24, 2012. Published online March 6, 2012. Recommended by Andrew Wathen.

†School of Mathematics, Iran University of Science and Technology, Narmak, Tehran, Iran (golbabai@iust.ac.ir).

‡Iran University of Science and Technology, Narmak, Tehran, Iran, and Department of Mathematics and Statistics, Allameh Tabatabai University, Tehran, Iran (a_safdari@iust.ac.ir).