

Fourier Series in a Non-polar Coordinate System

M.A.A.M. Faham¹ and H.M. Nasir²

¹*Department of Mathematical Sciences, South Eastern University of Sri Lanka, Sri Lanka*

²*Visiting Consultant, Sultan Qabool University, Muscat, Sultanate of Oman*

Corresponding Author: faham75@yahoo.com

Numerical computations of functions in a grid on the surface of a sphere and the integration of corresponding partial differential equation are very important tasks among the researchers in the field of computational mathematics. Although the spherical polar coordinate system is the most elegant tool in this respect, the problems due to polar concentration near the North and South poles brings much difficulties to the computational scientists. Cubed sphere concept is one of the techniques used recently in the processing of searching remedies for such problems. In earlier works, the second author of this article has constructed weakly and fully orthogonal spherical harmonics in a non-polar coordinate system developed based on the 'cubed-sphere' concept. Then, we established relational properties between the two sets of spherical harmonics and between the functions defined in the six faces of the cubed sphere. Fourier series techniques could be applied to a wide array of mathematical and physical problems. In this work, we express the Fourier series of a spherical function in terms of the weakly orthogonal spherical harmonics of the non-polar coordinate system. Also, we discuss the method of finding the Fourier series coefficients efficiently using the relational properties established.

Keywords: Computations, Spherical harmonics, Cubed sphere, Fourier series