# Relational Properties of Weakly Orthogonal and Orthogonal Spherical Harmonics in Cubed Sphere

M. A. A. M. Faham [1] * and H. M. Nasir2

Department ofMathematical Sciences, South Eastern University OfSri Lanka.
2Department ofMathematics, University ofPeradeniya, Sri Lanka.
*Corresponding Author: maamfaham@seu.ac.lk

Numerical computations on the sphere in solving problems defined on the sphere suffer from many difficulties near the poles when using spherical polar coordinate system for the spherical surface. For example, in the computations of global weather prediction models, concentrated grid points near the poles increase the amount of computations in the pole region where quantities of interest are of less important than in other parts of the globe. Such problems are collectively called as the 'pole problems'. Avoiding pole problems have attracted some researches in the recent past. One of the recent development in this direction is to define grid meshes on the sphere which do not contain polar concentrated points. Among these the 'cubed sphere' defined from the surface of a unit cube has been used by some authors for approximating weather prediction models by finite difference and finite element methods.

In a recent paper, one of the present authors has constructed weakly orthogonal spherical harmonics in a non-polar spherical co-ordinate system based on the cube sphere concept. This can be used for approximating functions on the sphere by spectral methods without the pole problems. In this work, we establish some lin ear and recurrence relations between these two sets of spherical harmonics. We also exploit linear relations between harmonic components defined in the six faces of the cubed sphere.

Key words: Non-polar spherical co-ordinate system, Cubed sphere, Spherical harmonics