Due to tedious manual calculations, lack of accuracy and limited domain of validity of analytical techniques, some numerical techniques were developed like method of moments (MOM), finite difference time domain (FDTD) and finite element method (FEM).

In [7], Johnson observed polarisation dependence of electromagnetic wave scattering from random rough surfaces and depolarisation of electromagnetic waves was observed by Valenzuela [8]. In [9], it was observed that Lunar crater deposits exhibit maximum CPR (Circular Polarisation Ratio, $\mu_c$) values of 2 to 3 at 12.6 and 70-cm wavelengths, Maxwell Montes on Venus range up to about 1.5 at 12.6-cm wavelength, Echoes from SP Flow in Arizona exhibit values up to 2 at 24-cm wavelength, rock edges and cracks (dipole-like) produce $\mu_c$ of unity for single scattering and up to about 2 for multiple reflections, Natural corner reflectors (dihedrals) formed by pairs of rock facets can yield an average value of 3 to 4. The CPR is defined as "the ratio between power reflected in the same sense of circular polarisation (SC) as that of transmitted and the echo in the opposite sense (OC) of circular polarisation" [9].

In [2], the authors through 2D FEM (finite element method) analysis show that highly porous substrates, possibly combined with nearly circular pebbles of ice atop can explain the high radar albedo from the Enceladus.

The above researches in the past have given the idea that different configurations of ice will generate different scattered electromagnetic field and will provide different values of radar cross section (RCS) and circular polarisation ratio (CPR). The RCS is defined as the ratio of the reflected radiation from the surface to incident radiation upon it.

**Objective**

To categorise different configurations of icy surfaces on the basis of two parameters: radar cross section (RCS) and circular polarisation ratio (CPR). Finally, to solve the mystery of getting high radar albedo from icy celestial bodies like Enceladus than the North/South pole of the Earth.

**Organisation of the thesis**

In Chapter 2, we analyse electromagnetic wave scattering from random rough surfaces by using small perturbation method (SPM) with a continuation in Chapter 3, derivation of scattered field for different orders of perturbation of the height of random rough surfaces. In Chapter 4, we analyse two configurations of icy surfaces: random rough surface and random rough surface with smooth square boulders, on the basis of RCS and CPR. In Chapter 5, we end our discussion with a conclusion.