2.0 LITERATURE REVIEW

1. Wilmore (1949) and Tranter (1961), in these two papers authors have considered the special cases of crack problems i.e. interaction between two straight cracks in an isotropic material.

2. Biot and Willis (1957), in this paper, authors have described the dynamical properties of materials, and one of the most classical theories is the Biot (1956) theory of consolidation of saturated media.

3. Sneddon (1966), in this paper authors has explored that the problems of cracks in materials have been less studied than the similar problems for classical linearly elastic materials, where the theory of cracks has already become one of the most developed classical theories In particular, exact explicit solutions have been obtained for numerous problems about a single crack, which permits calculating the stress intensity coefficient in the classical case.

4. Cruse (1972), in this paper author has modeled a straight crack as an open-cavity in the shape of an ellipse with a small radius of curvature. This model is unsatisfactory because it gives rise to an almost indeterminate system of linear algebraic equations. Apart from this, there is the difficulty associated with the stress singularities at the crack edges.

5. Goodman and Cowin (1972) and Cowin and Nunziato (1883) in these two papers, authors have proposed the theory that can be applied just to dry media and is based on the energy balance in the situation where the presence of cavities results in the appearance of an additional degree of freedom, namely, the relative volume of pores, which can vary in the deformation process. This theory adequately describes the behavior of certain geological rocks, some composite materials, certain industrial porous materials such as ceramics, and porous metals.

6. Snyder and Cruse (1975), in this paper, authors have proposed an approach to modify the fundamental singular solution for the boundary integral equation in such a way that the crack surface is not included in the path of integration. Such a modified fundamental singular solution or Green's function was obtained by for a stress-free planar crack in an anisotropic elastic material. The Green's function approach provides highly accurate results, especially in the computation of
the stresses near the crack edges. However, the only drawback is that the derivation of the Green's functions requires considerable mathematical effort and it is possible to obtain them explicitly in terms of known elementary functions for a rather limited class of crack problems.

7. Snyder and Cruse (1972), in this paper, authors have used a boundary integral formulation which avoids, by a suitable choice of Green's function, the need to integrate over the crack surface to solve a class of plane elasticity problems concerning a homogeneous anisotropic material with a stress free straight crack in its interior. In addition to overcoming the need to integrate over the crack surface where the stress singularities may cause difficulties with any numerical integration scheme used, this formulation does not require the crack to be modeled. In general, the modeling of the crack is not an easy task since the two faces of the crack lie on one and the same plane.

8. Clements and Haselgrove (1983), in this paper authors have included the case where the faces of the planar crack remain wholly in contact throughout the deformation of the material. A difficulty which arises in the use of numerical methods to solve crack problems in linear elasticity is associated with the stress singularities at the crack tips.

9. Wilton et al., (1984), in this paper authors have suggested an application of the method of moments with Galerkin's method to solve electromagnetic integral equations requires calculation of double integrals with singular kernels. Singular terms can be considered either by numerical methods (e.g. Duffy's method) or by singularity extraction technique.

10. Kaya and Erdogan (1987), in this paper authors have applied the boundary integral equation method usefully and effectively on numerical tool for analyzing linear elastic problems. Nevertheless, the direct application of the method to elastic crack problems encounters some difficulties. To begin with, the crack has to be modeled. For a problem with a certain symmetry (in its geometry and boundary conditions), this may be done by taking only half of the elastic material under consideration with one of the crack faces as part of the boundary. In general, the modeling of the crack is, however, not a trivial task since the opposite crack faces lie on one and the same surface.
11. Cruse (1988) has modeled the crack surface as an open-cavity in the shape of an ellipse with a small radius of curvature. This model fails to provide accurate results of the stresses near the crack. In fracture mechanics, an accurate determination of the stress field near the crack is essential.

12. Detournay and Cheng (1991) and Atkinson and Craster (1994), in these two papers authors have highlighted the case of several cracks of finite length was studied analytically in and numerically. But in the absence of the liquid the Biot consolidation theory, as a rule, leads to the same results as the classical theory of elasticity. However, numerous actual materials have porosity as dry substances. It is clear that the Biot theory cannot predict the mechanical properties of such media with cavities unsaturated by some liquid.

13. Rao and Wilton (1991), in this paper authors have studies that in an EFIE, there is a time derivative of a magnetic vector potential. By differentiating the EFIE with respect to time, this term is approximated by second-order finite differences, and an explicit solution has been presented. But the results become stable for late times.

14. Bugajewski (1992) and Dobner (1996), in these two papers, authors have argued on the related equations named dual series equations, triple series equations are equally fruitful for solving another class of mixed boundary value problems of mathematical physics. Other residual classes of equations which may come across during investigations shall be called as dual sequence equations etc.

15. Vechinski and Rao (1992), in this paper authors have suggested that late time oscillations could be eliminated by approximating the average value of the current. In this method, the incident field is also differentiated. The disadvantage of this procedure is that an impulse or step function for the incident field cannot be used as an excitation.

16. Furuta, (1993), in this paper authors have investigated that internal electrodes in electromechanical devices made of piezoelectric ceramics may act as conductive cracks or notches causing the devices to fail. Therefore, it is of theoretical significance and practical importance to study conductive cracks in piezoelectric ceramics.

17. Rao and Sarkar, (1993), in this paper authors have suggested the method on backward finite-difference approximation for the magnetic vector potential term has been presented for the
explicit technique.

18. Schmitz et al., (1993), in this paper authors have presented considerable analytical information about the crack is contained in the boundary integral equation (BIE) for crack problems. They suggested that many analytical results can be obtained by the BIE method.

19. Chung and Ting (1996), in their literature review, have stated the references of a lot of work done by various authors in past (Lynch et al., 1995; Ru and Mao, 1999), but only few are available in literature for three-dimensional problems.

20. Kauthen (1997) has investigated that the good source of these "mixed boundary value problems" are electrostatics, elastostatics, diffraction theory, acoustics, fluid mechanics, elasticity and potential theory. Further, he suggested that the classical procedure of treatment for mixed boundary value problems in these fields was not always simple and there was always a need for some alternative procedure for solving these ‘mixed boundary value problems’.

21. Sheng et al., (1998), in this paper authors have observed that if the RWG functions (Rao et al., 1982) are taken as both basis and test functions in the method of moments solution of the CFIE, the traditional form of CFIE leads to a very unstable solution. The reason is that only the electric surface current is well tested. As a remedy they suggest to test by both RWG and n*RWG functions, where n is the outer unit normal of the object. The most convenient formulation was obtained when the electric field part of CFIE is tested by RWG + n*RWG functions and the magnetic field part is tested by RWG functions. This formulation was named a TENENH formulation.

22. Hu (1999), in this paper authors has suggested various applications of special class of integral equations named as dual integral equations, triple integral equations and higher order integral equations.

23. Rao (1999), in this paper author has studied in recent years, on several formulations have been presented for the solution of the time-domain integral equation to calculate the electromagnetic scattering from arbitrarily shaped, three-dimensional structures using triangular patch modeling techniques.
24. Stavroulakis (2001), in this paper author has reviewed various research article on the application of GA or Evolutionary Algorithms (EA) in general, for identification of flaws, within the framework of Boundary Integral Equation procedures, have been explored by different authors in the past decade.

25. Zhang et al., (2001), in this paper authors have suggested that the analysis of an insulating crack under applied combined mechanical–electrical loading is a typical non-linear problem, and the exact solution is very difficult to be obtained due to the electric boundary condition on crack faces.

26. Cheng and Lu, (2002), in this paper, authors have explored that along with the wide applications in engineering, the fracture of piezoelectric ceramics has been drawing much attention.

27. Qin and Mai, (2002), in this paper authors have explored that the boundary element method (BEM) is particularly suited to the problems with stress concentrations or stress singularities. Many models have been proposed to make the BEM more effective. For example, in the single-domain BEM for 2-D anisotropic piezoelectric solids (Pan, 199), the extended displacement (displacement and electrical potential) and extended traction (traction and electric displacement) integral equations are collocated only on one side of the crack surface and the outside boundary (no-crack boundary) of the problem. Using Green’s functions for hole and inclusion problems and variational principle, the BEM for 2-D thermopiezoelectric media with holes, inclusions and cracks was proposed. The boundary condition on the hole circumference or the continuity condition of the interface between inclusion and matrix is satisfied a priori, and, thus, not involved in the boundary element equations.

28. Iovane et al. (2003), in this paper authors have developed a numerical method and justified that permits constructing the direct solution of hyper-singular integral equations without any additional auxiliary transformations, in contrast with the standard approach, which reduces the problem to an infinite system of linear algebraic equations. In the study done by Iovane et al. (2003), this method was applied to a problem of crack theory in a classical elastic medium.

29. McMeeking, (2004) in this paper author has suggested the solution, as well as the electric boundary condition on crack faces, depends on the crack opening, but the opening is unknown.
before the problem being solved. This problem puzzled researchers for a certain period of time in studying fracture of piezoelectric materials.