OPTIMIZATION OF CIRCULAR TILE CUTTER BLADE USING FEA

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Abstract - *An abstract summarizes, in one paragraph In the cutting operation Circular tile cutters having uniform radial cracks are widely used. Cutters are used to cut respective material to a required size or shape. They come in a number of different forms, from basic manual devices to complex attachments for power tools. Unwanted noise, vibration and accidental failure associated with the cutting process have become an important economic and technological aspect in the industry. The knowledge of natural frequencies of components is of great interest in the study of the response of structures to various excitations. In this study, natural frequencies will be evaluated in desired frequency ranges of cutter mechanism. Mode shapes at various natural frequencies will be evaluated using FEA results, CATIA V5 software will be used to design various existing blades and modification will be carried out as per results. Optimization to minimize the weight of circular tile cutter and thereby reducing the material cost. Conclusion and future scope will be suggested.*

Key Words: tile cutter, natural frequencies, Mode shapes, Optimization.

1. INTRODUCTION

It is standard that the presence of cracks can have an effect on the dynamic characteristics of the vibrating plate. Such a tangle is sophisticated as a result of it combines the sector of vibration analysis and fracture mechanics. Circular cutters with uniform radial cracks area unit extensively employed in the cutting processes. The information of natural frequencies of parts is of nice interest within the study of response of structures to varied excitations. Circular cutting tool could be a plate of circle with central hole that fastened at inner edge and free at border with its dynamic response.

2. VIBRATION ANALYSIS OF ANNULAR-LIKE PLATES

L Cheng et.al. [1] have stated that, existence of eccentricity of the central hole for Associate in Nursing annulated plate ends up in a major modification within the natural frequencies and mode shapes of the structure. during this paper, the vibration analysis of annular-like plates is bestowed supported numerical and experimental approaches. victimization the finite part analysis code Nastran, the results of the eccentricity, hole size and stipulation on vibration modes area unit investigated consistently through each international and native analyses. The results show that analyses for excellent regular conditions will still roughly predict the mode shapes of "recessive" modes of the plate with a rather eccentric hole. Experimental modal analysis on a clamped–free annular-like plate is performed, and also the results obtained reveal sensible agreement with those obtained by numerical analysis. This study provides steering on modal analysis, vibration mensuration and harm detection of plate-like structures.

3. VIBRATION OF CRACKED CIRCULAR PLATES AT RESONANCE FREQUENCY

Chi-Hung Huang [2] have investigated that the presence of cracks can have an effect on the dynamic characteristics of the moving plate. Such a tangle is difficult as a result of it combines the sphere of vibration analysis and fracture mechanics. during this study, Associate in Nursing optical system referred to as the AF-ESPI technique with the out-of-plane displacement measure is used to analyze the vibration characteristics of a free circular plate with a radial crack emanating from the sting. The boundary conditions on the circular edge area unit free. As compared with the "lm recording and optical reconstruction procedures used for holographic interferometry, the interferometric fringes of AF-ESPI area unit made instantly by a recording system. supported the actual fact that clear fringe patterns can seem solely at resonant frequencies, each resonant frequencies and corresponding mode shapes may be obtained by experimentation at constant time by the planned AF-ESPI technique. Numerical finite part calculations performed and therefore the results are compared with the experimental measurements. smart agreements area unit obtained for each results. The moving mode shapes obtained during this study may be classified into 2 sorts, rhombohedral and antisymmetric modes with relation to the crack line. The influence of crack length on resonant frequencies is additionally investigated in terms of the dimensionless frequency parameter (j2) versus crack length quantitative relation (a/D). we discover that if the crack face displacement is out of section, i.e., the antisymmetric sort, an oversized price of stress intensity issue could also be elicited and therefore the cracked circular plate are dangerous, from

the fracture mechanics purpose of read. However, there area unit some resonant frequencies that the crack face displacements area unit utterly in section, i.e., the rhombohedral sort, that yields a zero stress intensity issue and therefore the cracked plate are safe.

4. EIGEN SOLUTIONS OF A CIRCULAR FLEXURAL PLATE WITH MULTIPLE CIRCULAR HOLES USING THE DIRECT BIEM AND ADDITION THEOREM

W.M. Lee et.al. [3] have studied an associatealytical formulation to explain the free vibration of a circular flexural plate with multiple circular holes by victimisation the null field integral formulation, the addition theorem and complicated Fourier series. thanks to the addition theorem, all kernel functions square measure portrayed within the degenerate type and more remodeled into an equivalent polar coordinates targeted at one in every of circles, wherever the boundary conditions square measure such. Thus, not solely the computation of the principal worth for integrals is avoided however conjointly the calculation of higher-order derivatives within the flexural plate downside is simply determined. By matching the required boundary conditions, a coupled infinite system of synchronal linear pure mathematics equations comes as associate analytical model for the title downside. in keeping with the direct looking out approach, natural frequencies square measure numerically determined through the singular worth decomposition (SVD) within the truncated finite system. once crucial the unknown Fourier coefficients, the corresponding mode shapes square measure obtained by victimisation the direct boundary integral formulations for the domain points. many numerical results square measure given.

5. GEOMETRICALLY NONLINEAR FREE VIBRATIONS OF SIMPLY SUPPORTED ISOTROPIC THIN CIRCULAR PLATES

M. Haterbouchet.al. [4] have studied nonlinear free axis symmetric vibration of merely supported isotropic circular plates is investigated by mistreatment the energy technique and a multimode approach. In-plane deformation is enclosed within the formulation. Lagrange's equations ar accustomed derive the governing equation of motion. mistreatment the harmonic balance technique, the equation of motion is regenerate into a nonlinear algebraical kind. The numerical reiterative technique of resolution adopted here is that the alleged linearized updated mode technique, which allows the authors to get correct results for vibration amplitudes up to 3 times the plate thickness. the share of participation of every out-of-plane basic operate to the deflection form and to the bending stress at the plate center and of every in-plane basic operate to the membrane stress at the middle ar calculated so as to work out the minimum range of in- and out-of-plane basic functions to be utilized in order to realize

an honest accuracy of the model. The nonlinear frequency, the nonlinear elementary mode form and their associated nonlinear bending and membrane stresses ar determined at massive amplitudes of vibration. The numerical results obtained here ar conferred and compared with obtainable printed results, supported varied approaches and with the single-mode resolution. The limit of validity of the single-mode approach is additionally investigated.

6. ANALYTICAL AND EXPERIMENTAL INVESTIGATION ON TRANSVERSE VIBRATION OF SOLID, CIRCULAR AND ANNULAR PLATESCARRYING A CONCENTRATED MASS AT AN ARBITRARY POSITION WITH MARINE APPLICATIONS

D.V. Bambillet.al. [5] have investigated arose from the sensible necessity of inserting a pump bolt connected to a skinny, circular covering of a cistern in a very medium size ocean vessel. as a result of lack of house, it had been necessary to find the system off—center of the circular configuration. it had been required to calculate the basic frequency of the coupled system. the primary a part of this study cares with the determination of the basic frequency of vibration of a circular plate carrying a targeted mass at associate degree absolute position, employing a wave approach. Numerical results ar obtained for the expressed downside for many combos of the intervening geometric and mechanical parameters. associate degree experimental investigation is additionally performed within the case of clamped plates. supported the results for solid circular plates, the basic frequency of ring-shaped plates with a free inner edge and a targeted mass is additionally obtained. Circular plates ar basic structural parts in ocean engineering applications: from off-shore platforms to underwater acoustic transducers. in a very nice sort of circumstances, they need to carry operational systems in associate degree eccentric fashion. Since the dynamic performance is often of interest, one should apprehend a minimum of a number of the essential dynamic parameters.

7. VIBRATION OF PLATES WITH ARBITRARY SHAPES OF CUTOUTS

SasankSekharHotaet.al. [6] have investigated that amalgamation of a sub constant quantity triangular plate bending part with first-order shear deformation has occurred for the primary time with associate degree approach that maintains uniform mesh sizes and shapes even whereas addressing cutouts of discretionary shapes. this can be a definite improvement over the prevailing practices of cutout modeling. more the formulation being supported the sub constant quantity part has the advantage of achieving matching modes, that permits the model to deal issues of terribly skinny plates while not even going for reduced integration. Numerical examples on free vibration of

plates with cutouts are analyzed and also the results bestowed at the side of those out there in printed literature.

8. CONCLUSIONS

From the literature survey it is seen that Optimization Of Circular Tile Cutter Blade has been a hot research topic for many researchers, due to its important role in adoption of new market requirements. The researchers started from developing theories related to general behavior of circular plate and further moving to implementing the optimizing various parameters according to their application. In order to reduce the natural frequency it is necessary to optimize the design space and weight to effectiveness ratio to get better realistic results.

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