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REVIEW ON ANALYSIS AND OPTIMIZATION OF HYDRAULIC COTTON LINT BAILING PRESS

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ABSTRACT

Ginning is the process of separation of fiber from cottonseed. Composite ginnery performs ginning and pressing operations to convert lint cotton into a bale. In modern day, capacity of ginning plant is such that the cotton bale handled by their press system gives rise to very large forces. Frame structure like all the other equipment has to be able to withstand these forces without damage. It is essential that the calculations for mechanical strength to check the suitability of top and bottom frame and their supports for hydraulic forces in cotton bale press at required level and duration in the system. The present paper is a review of the FEA analysis techniques of framed structure used in the recent past.

Keywords: FEA, frame structure, hydraulic press.

INTRODUCTION

Bale packaging is the final step in processing cotton at the gin. The packaging system consists of a battery condenser, lint slide, lint feeder, tramper, bale press, and bale tying mechanism. This system may be supplemented with systems for bale conveying, weighing, and wrapping. The bale press consists of a frame, one or more hydraulic rams, and a hydraulic power system.

Bale presses are described primarily by the density of the bale that they produce, such as low.

Density (flat or modified flat) or universal density gin or compress, other descriptions include up-packing, down-packing, fixed box, and door less. Regardless of description, they all package Lint cotton so that it can be handled in trade channels and at textile mills.

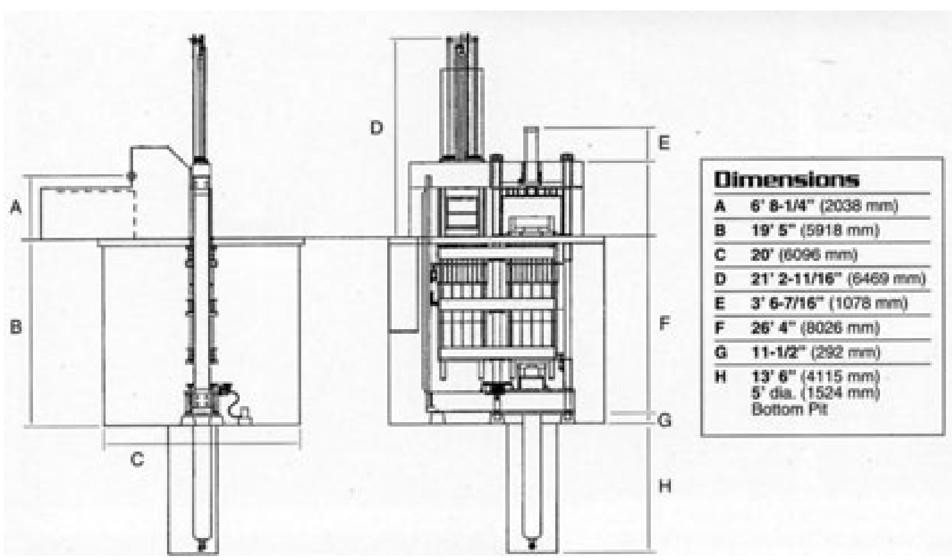

Figure-1. Continental eagle model 930 magnum universal density press.

Four types of gin presses have been used; each type is named according to the bale it produces -flat, modified flat (bales to be sent for recompression to become compress universal density bales), gin standard, and gin universal. Today all of the bales produced at gins in the United States are gin universal density.

Hydraulically operated up packing cotton lint baling press

The Jadhav Zen Door-Less Bale Press is designed to be "energy efficient". It uses a Single 2 no's x 250 mm in diameter-ram. Features include a super high capacity lint feeder and a totally enclosed right-angle gear drive tramper. A unique follow block and platen design enables square knot type wire to be applied manually and semi-automatically. Automatic strapping and wire tying systems are also applicable to the variable shut-height system.

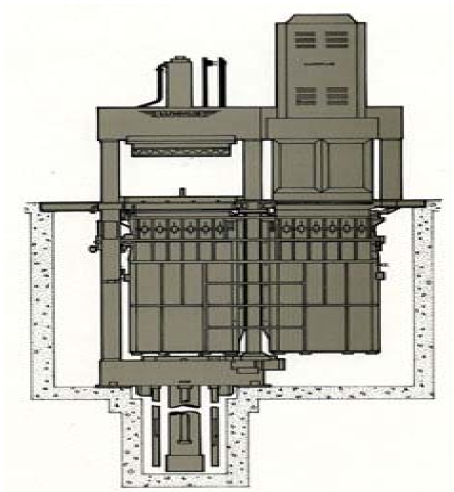

Figure-2. Jadhav Zen up packing dor-less press.

Structural design is a branch of Engineering that deals with systems comprised from a set of structural members. These members may be characterized as either truss or frame elements, connected by pinned or fixed joints. Structural optimization has become a valuable tool for engineers and designers in recent years. Structures are becoming lighter, stronger, and cheaper as industry adopts higher forms of optimization. This type of problem solving and product improvement is now a crucial part of the design process in today's engineering industry. The topic of optimization has its mathematical roots dating back to the 1670's with the introduction of differential calculus.

REVIEW OF WORK CARRIED OUT

Neville Saches [1], in this paper the Author focused on the causes of failure for understanding mechanical failure in machines components. Paper gives the brief introductions about the ductile fracture, fatigue failure and stress concentration. Paper also discussed the type of load is responsible to failure i.e., internal pressure, bending, torsion or a combination.

P.E. Uys, K. Jarmai, J. Farkas [2], in this paper Authors attempt to find the most cost effective design of a multipurpose hoisting device that can be easily mounted on and removed from a regular farm vehicle, cost optimization including both material and manufacturing expenditure, is performed on the main frame supporting the device. The optimization is constrained by local and global buckling and fatigue conditions. The optimization problem is solved by means of the leap-frog algorithm for constrained optimization of Snyman. This gradient-based method, requiring no explicit line searches, is a proven robust and reliable method, being relatively insensitive to local inaccuracies and discontinuities in the gradients.

B. Tadic, P.M. Todorovic, B.M. Jeremic [3], in this paper are the results pertaining to technical condition diagnostics, redesign, and analysis of its effects for a complex mechanical system of a polypropylene yarn twisting machine. Stress analysis before and after the redesign of the foundation framework of the twisting machine leads to the conclusion that Von-Mises stress was reduced by more than eight times in the critical crack zone. FEM analysis was conducted in Autodesk Inventor Simulation software. FEM analysis also revealed significant drops in stress in crack zones. The results of FEM analysis which simulated loads and the stress field which correspond to measured and calculated displacements in the crack zone, before and after the redesign, revealed a significant drop in stress in the crack zone. The authors think that the relationship established between experimentally and theoretically defined displacements, and loads in the crack zone can be successfully used for analysis of complex technical systems which do not allow exact determination of framework loads.

Gino J. Mangialardi, Jr. W. Stanley Anthony [4] , they describes the design and operation of various types and models of bale presses, and gives an appraisal of press designs and adjustments that may be most useful at current cotton gins. The paper describes up-packing and down packing presses; flat (low density), standard density, high density, and universal density types; and some accessories used with cotton baling systems. Materials from the review are arranged chronologically. The complied information and recommendations should prove useful to ginners, scientists planning future ginning studies, and engineer's selecting cotton bale press designs and types for commercial gins.

M. S. Edke, K. H. Chang [5], addresses the trade-off between structural performance and manufacturing cost of heavy load carrying components by incorporating virtual machining (VM) technique in computer-aided design (CAD)-based shape optimization problem. A structural shape optimization problem is set up to minimize total cost, subject to the limits on structural performance measures. For every design iteration, finite element analysis (FEA) is conducted to evaluate structural performance, and VMis employed to ascertain mach inability and estimate machining time. Design sensitivity coefficients of objective function and constraints are computed and supplied to the optimization algorithm. Based on the gradients, the algorithm determines design changes, which are used to update FEA and VM models. The process is repeated until specified convergence criterion is satisfied. The CAD model from Solid Works is imported into ANSYS through the IGES interface. The FEA model is then constructed and archived in the ASCIIA application programs developed to integrate commercially available CAD/CAM/FEA Design optimization tools enable implementation in virtual environment and facilitate automation. The application programs can be reused for similar design problems provided that the same set of tools is used.

H.T. S´anchez, M. Estrems, F. Faura [6], their aim to investigate the procedure for studying deformation errors in the machine structure, which integrates positioning and deflecting fixturing analysis methods. These methods are applied to the special case of flexible work pieces, which are fixed by hyperstatical fixturing systems when the roughing and finishing operations are carried out in the same setup. Once these errors have been calculated by the integrating procedure, all the information is introduced in a CADCAM database so that the above errors can be compensated during the machining operation by means of a new cutting tool path provided by the CADCAM program.

Osama Bedair [7], their aim was to present an efficient numerical procedure for dynamic analysis of box girders with tee stiffeners utilizing unconstrained optimization techniques. The procedure can be utilized in the industry very effectively for the analysis of box girders. The potential energy of the structure is expressed in terms generalized functions that describe the longitudinal and transverse displacement profiles. The problem is then converted into unconstrained optimization in which mathematical programming techniques are employed to determine the magnitude of the lowest natural frequency and the associated mode shape for pre-selected geometric parameters.

Kee Poong Kim a, Hoon Huh b [8], this paper introduces an extended concept of limit analysis to deal with the dynamic equilibrium condition considering the inertia and strain-rate effect for dynamic behavior of structures. The conventional limit analysis method has been applied to only static collapse analysis of structures without consideration of dynamic effects in the structural behavior.

LeRoy Fitzwater, Richard Khalil, Ethan Hunter [9], the topology optimization method outlined herein provides convincing evidence to re-think the way aircraft structure is designed. Topology optimization is gaining popularity and requires some further development to document the effective use of this tool and to aid the engineer in producing quality designs. The benefits are numerous, including load path visualization, weight savings, increased systems design space, improved ballistic protection and fatigue resistance. These benefits offer a compelling incentive to employ this technology into the current design process to improve the performance of engineering products. Following figure shows the optimizations steps.

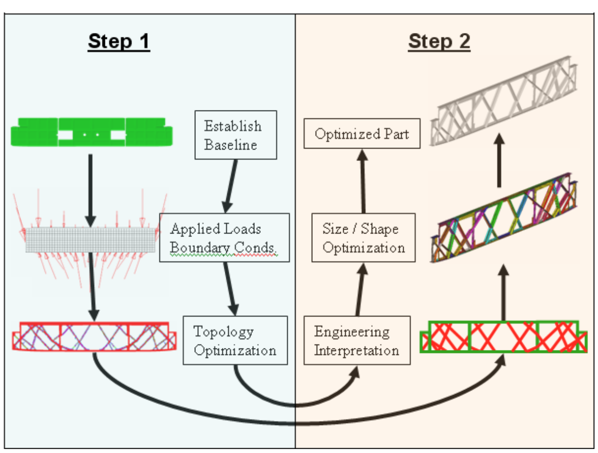

Figure-3. FEA optimization process.

C.-C. LIANG, G.-N. LE [10], this paper presents an efficient and robust analysis method with which to design the bus superstructure for a reduction in occupant injuries from rollover accidents while the weight of the strengthened bus is maintained at the same level. First, the absorbed energy of the bus frame and its components during a rollover were investigated by using a LS-DYNA numerical study. The highest energy absorption region, which is the side section of the bus frame, was found and focused on for the investigation of a means to re-distribute the energy-absorption ability of the side frame component. Then the thickness parameters that were obtained from the re-distribution of the energy-absorption ability were used in the analysis to optimize the design. Following figure shows the result analysis after optimizations processes.

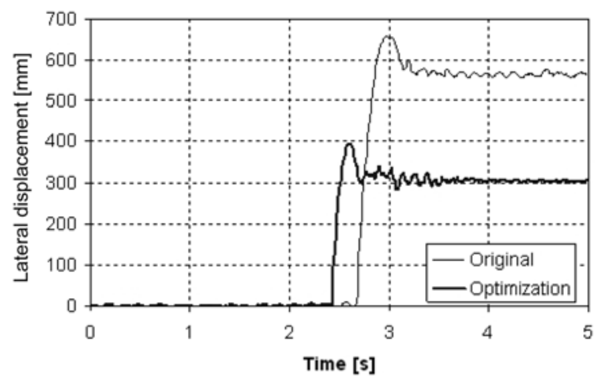

Figure-4. Upper displacement of bus frame (Optimization versus original).

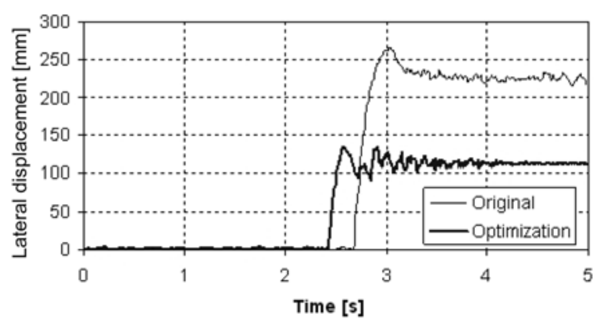

Figure-5. Lower displacement of bus frame (Optimization versus original).

CONCLUSIONS

The proposed design process successfully incorporates machining cost into a structural shape optimization problem. In addition to ensuring manufacturability of the structurally optimized components, the design process delivers components with minimum cost and required performance. The trade-off between structural performance and machining cost is highlighted using two design examples. Furthermore, the process starts with preliminary information about the component and delivers optimum components at the end.

The design calculations of Hydraulic press system are playing important role as we come to know the value of total force develops in the system. The value of tensile stresses developed in the system is greater than the permissible limit. Selection of good shape provides strength to the system as the system is only undergoing through bending according to the FEA Analysis the best solution is obtained by changing the shape and design of the top and bottom frame structure.

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