A Review paper on Optimization of Industrial lift platform by using sandwich Panel

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Abstract: A sandwich has increased the importance of efficient structural arrangements. In principle two approaches exist to develop efficient structures: either application of new materials or the use of new structural design. A proven and well-established solution is the use of composite materials and sandwich structures. In this way high strength to weight ratio and minimum weight can be obtained.

The sandwich structures have potential to offer a wide range of attractive design solutions. In addition to the obtained weight reduction, these solutions can often bring space savings, fire resistance, noise control and improved heating and cooling performance. Laser-welded metallic sandwich panels offer a number of outstanding properties allowing the designer to develop light and efficient structural configurations for a large variety of applications.

Key Point: Structural Analysis, ANSYS 14.5, Sandwich structure.

I. INTRODUCTION

Sandwich panels in general can be classified as: composite sandwich and metallic sandwich panels. Composite sandwich panels consist of non-metallic components such as FRP, PU foam etc. and are typically applied as load carrying structures in naval vessels and leisure yachts, and mainly as non-load carrying elements on merchant and large cruise ships. For metallic sandwich panels there are basically two types of panels: panels with metallic face plates and bonded core such as SPS panels and panels with both metallic face plates and core welded together. The metal material can be either regular, high tensile or stainless steel, or aluminum alloys. This paper focuses on steel sandwich panels welded by laser. The steel sandwich panels can be constructed with various types of cores as summarized in Figure 1. The choice of the core depends on the application under consideration. The standard cores such as Z-, tube- and hat profiles are easier to get and they are typically accurate enough for the demanding laser welding process. The special cores, such as corrugated core (V-type panel) and I-core, need specific equipment for production, but they usually result with the lightest panels. Naturally, during the production process or after welding of faceplates plates and core together, the steel sandwich panels can also be filled with some polymer, mineral or rock wool, concrete etc. to improve the behavior for specific targets.

II. PROBLEM STATEMENT AND SOLUTION

In Industrial lift they used large thickness of base for the lift to carry maximum amount of load on platform of lift.

Due to this consideration I found that there is a use of more thick material used for base of lift due to this weight of lift increased. For this they used more capacity of motor to run that lift. If we optimize that base of the lift, then also reduced the motor capacity and electricity used for lift.

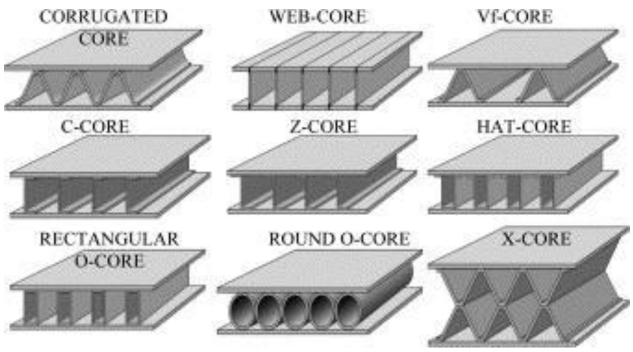

Fig 1.Different steel sandwich structure with various cores

Sandwich panels and in particular laser welded sandwich panels offer a number of benefits, such as:

• Good stiffness to weight ratio offering a weight saving potential of up to 50% as compared to traditional stiffened plates;

• Less space consumption and the smaller total height of structure, comprising steel decks and underlying systems like cables, tubes and insulation;

• Good properties regarding heat insulation, noise damping and fire safety, in particular when filling materials or top layers are implemented; weight and man hour consumption of external insulation can be drastically reduced due to the flat surface of the sandwich panels;

• Significantly improved crashworthiness, with filling materials further increasing crashworthiness;
• High pre-manufacturing accuracy and flatness, reducing the amount of fairing and fitting work in outfitting; no need for floor leveling for sandwich structures.

III. Literature review

Laser welded stainless steel sandwich panels have big potential in wide range of attractive design solutions. The correct design of the details of the sandwich constructions is of great importance as well as the analysis of deflections, stresses and buckling loads. Joint of sandwich panel to other sandwich panels or to other structures is one of the key elements in the practical applications of these constructions. The results of the studies have indicated that austenitic stainless steel grade 1.4301 (AISI 304) can be used in laser welded sandwich panels offering good mechanical properties and corrosion resistance. The use of higher strength austenitic stainless steel as sandwich panels was shown to be reasonable when substantial weight reduction of load bearing structures is desired. In addition to laser welding the development of resistance and spot welding, adhesive bonding and weld-bonding processes will increase the variety of efficient techniques in manufacturing of stainless steel sandwich structures in the future. [1]
A finite element model of corrugated board containers is shown to predict the failure load of boxes, made from B- and C-board, within an average error margin of 5%.
Effective material properties of the homogenized corrugated cores have been used, and each layer of the corrugated board is assumed to be orthotropic linear elastic. It is shown that convergence is obtained with relatively few elements, e.g. 64 elements are quite sufficient for a regular size box, i.e. 300x300x300 mm. The edge stiffness has a significant influence on the predicted failure loads because it affects the load distribution on the top and bottom edges when the side panels buckle. There is also a variation of about 10% in the failure load due to different buckling modes. This is attributed to different constraints imposed on the side panels by the corners of a box. Boxes of different sizes and board grades were tested and compared to predicted strengths. On average, the difference between experimental and predicted values was small. However, for some boxes the difference was significant because the boxes did not buckle but were crushed instead. [2]
There has been a lot of research activities in Europe related to the development of laser welded steel sandwich panels. The work carried out includes the development of design formulations for the ultimate and impact strength, analysis of fatigue strength for the joints, and development of solutions to improve the behavior under fire and noise. New factories have been established to produce these types of panels, which enables larger scale implementations of the panels for various types of ships in the near future.
Optimal design of steel sandwich panel applications in ships is a complex task, comprising many subtasks, such as load modelling, response calculations and optimization. Following this principle, a redesign of hoistable cardeck was performed, including the minimization of weight and cost of production. Two advanced sandwich alternatives were suggested instead of the traditional paneled structure and were then optimized.
Paper gives evidence that the hoistable cardeck with sandwich paneling can now be designed in the preliminary faze without using the finite element methods. This seriously shortens the design time, which is of great importance to a designer. One optimization run, on a typical PC, took only couple of minutes, thus enabling the variability and offering more freedom to designer to explore new concepts. [3]
A theory for the bending response of laser-welded web-core sandwich plates was developed in this thesis. The theory is suitable for the concept design of ship structures. It considers the periodic structure when the stiffness properties of a homogenized plate are derived. The plate-bending problem is solved for the homogenized plate. As a result the deflections and internal forces are obtained for the homogenized plate. When the internal forces are known, the periodic structure is reconsidered and the discrete stresses are calculated. In addition, a method to evaluate the local stress response resulting from the application of loads directly onto the face plates was developed. When these two analyses are considered together, the total response of the web-core sandwich panel is known. It was seen that the most important stress component is caused by local patch loads. This is followed by shear-induced stresses. The normal forces and bending moments of a homogenized sandwich plate are found to have a slight influence on the total stress response.
It was seen that the rigidity of the connection between the face and web plate is very important when the response is considered. This influence of the laser weld rotation stiffness was included in the formulation of the shear stiffness.
The laser-welded connection transfers out-of-plane, in-plane, and moment loads to the face plates. Depending on the stiffness of the web plate and the laser weld, the moment that rotates the laser weld is transferred to the face plate. This same moment creates in-plane forces on the face plates. When the moment has a value close to zero, the web plate is not capable of transferring in-plane loads to the face plates; the thick face plate effect carries most of the load. Such a situation can occur when the web plates are very thin or the rotation stiffness of the laser weld is very small. [4]

IV. Objective of Project:

Objective of this project is to increase equivalent stress strength of composite structure and also reduction of weight of composite structure as compare to conventional steel structure. For that various methods available to increase strength and reduction of weight but in this project we considered only two major parameters that have major influence on strength and reduction of weight. The objective is to increase strength by varying parameters and find the best to suit requirement and that have maximum strength and having minimum weight as compare to other conventional structure.
Following are the major objectives of Project.
1. The major objective of the proposed research work is to enhance the equivalent stress at minimum weight.
2. To propose a material which sustain maximum possible strength at minimum weight.
3. Analyze Effect of equivalent stress on composite structure.

4. Analyze Effect of weight on composite structure
5. Compare the numerical, experimental result with FEA analysis result.

V. Scope of work:

Sandwich panels are modeled in CATIA. The top and bottom plates, core parts are modeled by using CATIA. The three parts are assembled by using assembling command. Then the assembled part is saved in STP format and imported to ANSYS workbench. In ANSYS Workbench the STP format is imported and geometry will show three contact pairs. Materials properties are given to the individual part i.e., top and bottom plates are selected and mild steel properties are given to them. Now by solving the structure the deflection and von misses stress are noted. By changing the corrugated core and same is modeled and analyzed the variation in deflection and von misses and weights are compared.

Design and Analysis of Sandwich Structures.

Sandwich panels are modeled in PRO/E. The top and bottom plates are modeled by using extrude command and the core part is modeled by using sweep command. The three parts are assembled by using assembling command. Then the assembled part is saved in IGS format and imported to ANSYS workbench. In ANSYS Workbench the IGS format is imported and geometry will show three contact pairs. Materials properties are given to the individual part i.e., top and bottom plates are selected and stainless steel properties are given to them. Now core is selected and mild steel properties are given. Now mesh the geometry as free mapped mesh and structural analysis is done by fixing the plate at bottom and pressure is applied at top face of the plate as shown in fig. now by solving the structure the deflection and von misses stress are noted. By changing the wave length of corrugated core and same is modeled and analyzed at a constant pressure the variation in deflection and von misses are compared.

VI. Compression test

Steel sandwich structure with stainless steel faces and mild steel core are joined by welding and compression test is conducted on Universal testing machine (UTM) and ultimate stress and deflection are studied. The in plane compression testing of sandwich structure was performed on universal testing machine (UTM) having capacity 400KN. The samples were placed between hardened end plates in order to protect the surface of the machine's platens. Load is applied uniformly and deflection and compression strength are noted.

VII. Importance:

- High resistance to fatigue and corrosion degradation.
- High 'strength or stiffness to weight' ratio. As enumerated above, weight savings are significant ranging from 25-45% of the weight of conventional metallic designs.
- Due to greater reliability, there are fewer inspections and structural repairs.
- Directional tailoring capabilities to meet the design requirements. The fiber pattern can be laid in a manner that will tailor the structure to efficiently sustain the applied loads.
- High resistance to impact damage.
- Thermoplastics have rapid process cycles, making them attractive for high volume commercial applications that traditionally have been the domain of sheet metals. Moreover, thermoplastics can also be reformed.
- Like metals, thermoplastics have indefinite shelf life.
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VIII. Reference

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