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To Study Design Parameters and analysis of Ductile Plate of Various Materials by using FEA

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ABSTRACT

The study represent new approach to find out strength of plates with the help of Finite element method by using Response surface modeling In Probabilistic design we can get which plate can give the maximum strength of plates. In this analysis three plates are taken into consideration, these are structural steel, stainless steel, aluminum alloy.

Key words:- Simulation, Plates analysis by FEA and Response surface modeling

I.INTRODUCTION

In industry there are different types of plates are used. For example structural steel, stainless steel, aluminum plates are used. In which stainless steel plate is used for food processing, chemical processing, power generation, high vacuum and brewing, etc also structural steel plate is used in pulp and paper industries, pharmaceutical, etc and aluminum alloy is used in heavy duty application such as aerospace, etc.

In this paper numerical methodology for the elastic analysis of single plate is presented which taken into account any unilateral support condition that can occur in one or more supporting boundary's. The plates are discretized with a fine mesh of finite element and the unilateral supported conditions are simulated through proper link elements while the determination of the up lifted regions of the plates is part of problems solution a parametric study is then carried out for rectangular edge supported plates for various combination of support conditions and aspect ratios.[1] A simple rational model is developed in this paper to determine the structural behavior of steel plate wall (SPW) systems, and is referred to as the Modified Plate–Frame Interaction (M-PFI) model. The model considers bending and shear behavior, and the interaction of the two, for the SPW system. It is a modification of the Plate–Frame Interaction (PFI) model that only considers the shear response of the SPW system. The proposed M-PFI model can determine force and displacement values that correspond to the pre- and post-critical buckling state, the yield state, and the ultimate capacity of individual panels. In the end, design requirements for the beams and columns (also known as horizontal and vertical boundary elements) of the SPW are derived using the underlying theory of the M-PFI model.[2] For the past few decades global attention and interest has grown in the application of Ductile Steel Plate Walls (DSPW) for building lateral load resisting systems. Advantages of using DSPWs in a building as lateral force resisting system compromise stable hysteretic characteristics, high plastic energy absorption capacity and enhanced stiffness, strength and ductility. A significant number of experimental and analytical studies have been carried out to establish analysis and design methods for such lateral resisting systems, however, there is still a need for a general analysis and design methodology that not only accounts for the interaction of the plates and the framing system but also can be used to define the yield and ultimate resistance capacity of the DSPW in bending and shear combination. In this paper an analytical model of the DSPW that characterizes the structural capacity in the shear and bending interaction is presented and discussed.[3]

II .SIMULATION

1. Finite element analysis of structural steel plate

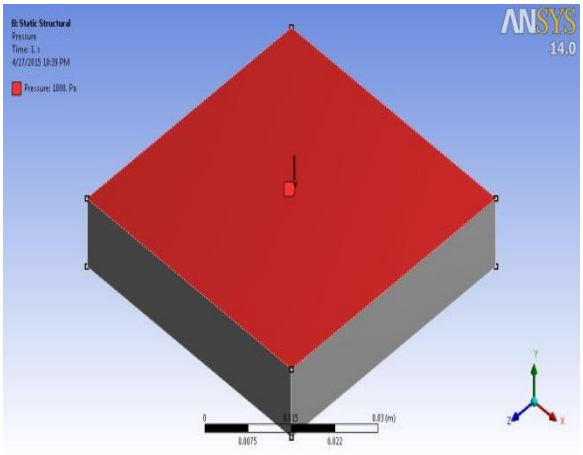

Fig.2.1 Geometry of the Plate in ANSYS

1. Finite element analysis of structural steel plate

Analysis has been carried out in ANSYS work bench. Constrained geometry of the plate is as shown in fig. 2.1.
In table No. 2.1Material properties of structural steel plate are given below ;

Sr. No.	Material Properties	Value
1	Density (kg/m3)	7850
2	Young's modulus (Pa)	2.10e11
3	Poisson's ratio	0.3
4	Ultimate tensile strength (Pa)	4.6e8
5	Yield tensile strength (Pa)	2.5e8
6	Yield comp. strength (Pa)	2.5e8
7	Specific heat(J Kg-1 c-1)	434
8	Coefficient of thermal expansion (c^{-1})	1.2e-5

In table No. 2.1 Simulation of plate is done by using response surface modeling in ANSYS workbench (FEA). Geometry is meshed by using brick element. Total number of nodes 25620 and elements 4850 are generated after meshing. One end of the spring is fixed in all direction while load is applied in negative Y direction at another end.It is shown in figure 2.2

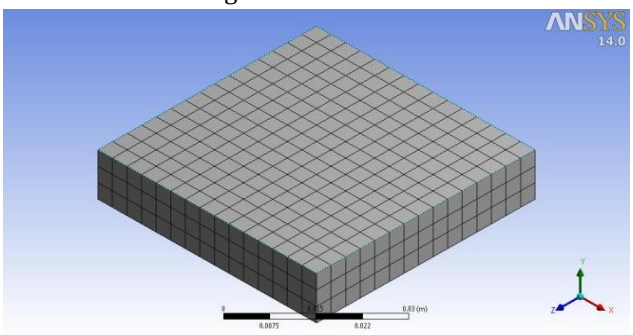

Fig.2.1 Meshed modal of structural steel plate

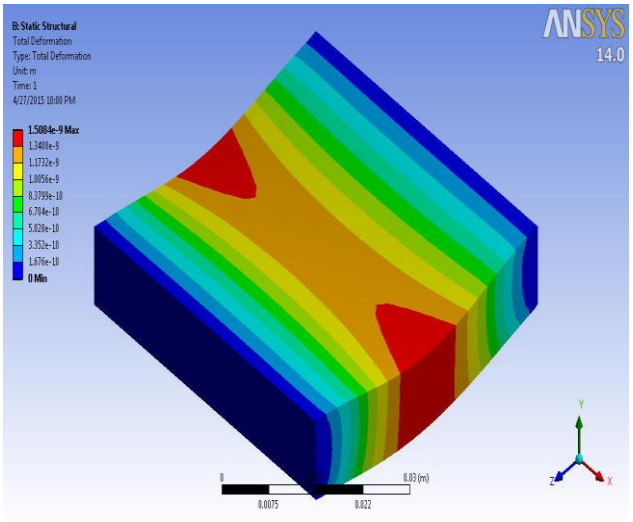

Fig.2.3. Total deformation of plate (structural steel)

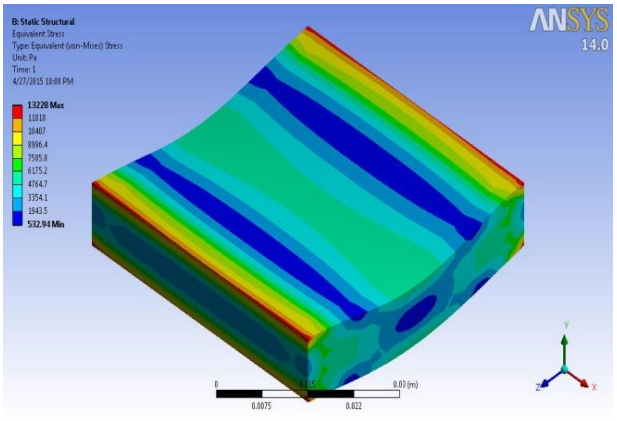

Fig.2.4. Equivalent stress of helical coil spring

1. Finite element analysis of Aluminum plate

Analysis has been carried out in ANSYS work bench. Constrained geometry of the plate is as shown in figure 2.1.

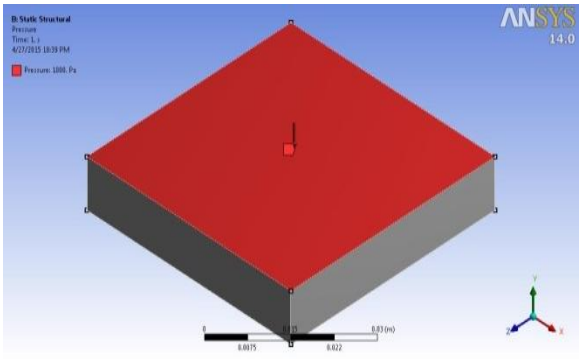

Fig.2.1 Geometry of the Plate in ANSYS

The Simulation of plate is done by using response surface modeling in ANSYS workbench (FEA). Geometry is meshed by using brick element. Total number of nodes 25620 and elements 4850 are generated after meshing. One end of the Plate is fixed in all direction while load is applied in negative Y direction at another end.It is shown in figure 2.2

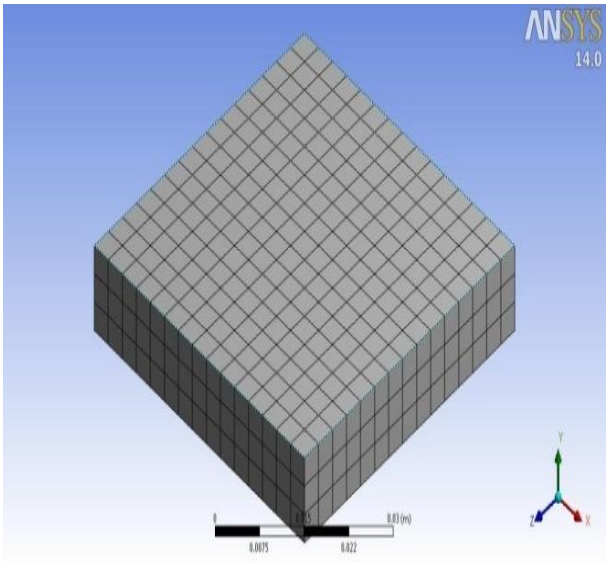

Fig.3.1 Meshed modal of Aluminium plate

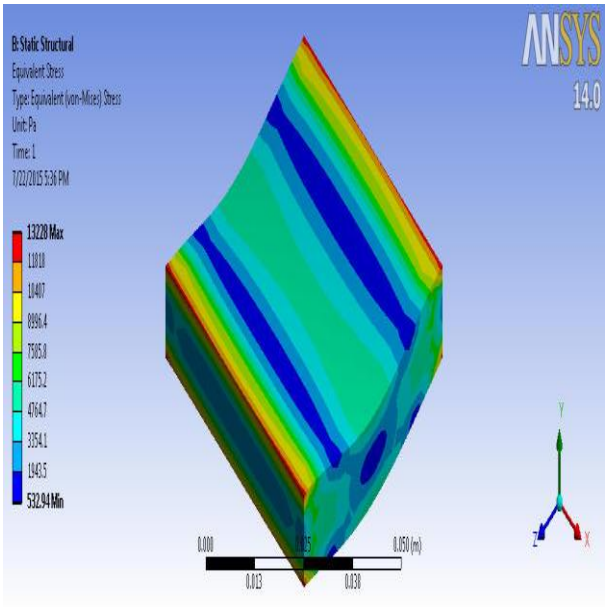

Fig.3.3. Equivalent stress on Aluminum alloy

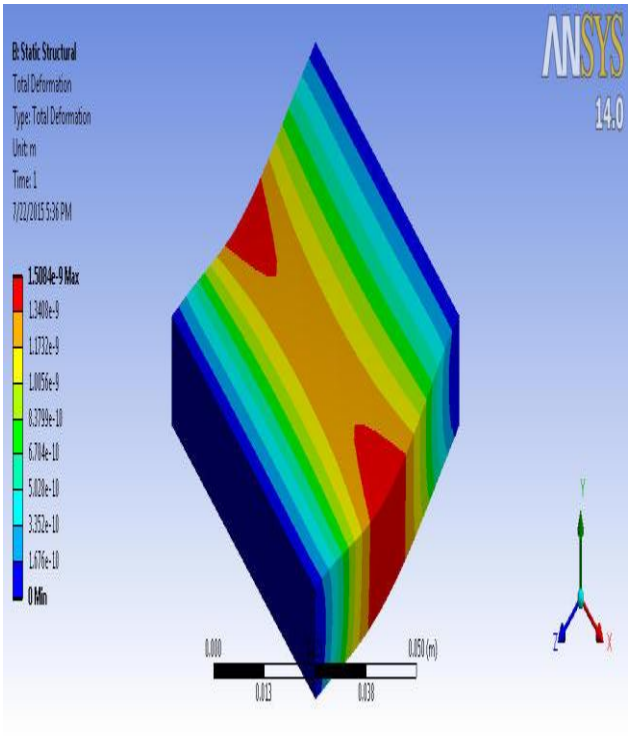

Fig.3.2. Total deformation of plate Aluminum alloy

In table No. 2.1Material properties of Aluminum plate are given below ;

Sr.No.	Material Property	Value
1	Density (kg/m3)	2770
2	Young's modulus (Pa)	0.70e11
3	Poisson's ratio	0.32
4	Ultimate tensile strength (Pa)	3.1e8
5	Yield tensile strength (Pa)	2.3e8
6	Yield comp. strength (Pa)	2.3e8
7	Specific heat(J Kg-1 c-1)	875
8	Coefficient of thermal expansion (c^{-1})	2.3e-5

IV.CONCLUSION

-Finite element analysis of plates has been carried out by using workbench.

-It is observed that strength of steel plate is more than aluminum plate.

-In the analysis both plate has same dimension and applied force, the more stresses acting on aluminum plate than steel plate

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