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Design and Analysis of Travelling Block used in Rigs

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***Abstract*—A traveling block is the freely moving section of a block and tackle that contains a set of pulleys or sheaves through which the drill line (wire rope) is threaded or revved and is opposite (and under) the crown block (the stationary section)[1]. In the present work the geometric model is created in CATIA Software and imported to hyper mesh for convergent Finite element mesh and analysis. Stress and displacement on travelling block are calculated by using ANSYS software**

***Keywords*— Ansys, CATIA, FEM, RIGS, Hyper mesh etc.,**

I. INTRODUCTION

A traveling block is the freely moving section of a block and tackle that contains a set of pulleys or sheaves through which the drill line (wire rope) is threaded or revved and is opposite (and under) the crown block (the stationary section). The combination of the traveling block, crown block and wire rope drill line gives the ability to lift weights in the hundreds of thousands of pounds. On larger drilling rigs, when rising and lowering the derrick[2], line tensions over a million pounds are not unusual. Depending on the load travelling block are classified into two fall pulley travelling block and four fall pulley travelling block for heavier loads or else two fall pulley travelling block for lighter loads It moves inside the mast structure from top to bottom on guide way provided inside mast structure having pulleys inside the travelling block with one end attached to the hydraulic cylinder[4]. Travelling block helps in moving the rotary head gearbox in the ratio of 1:1 or 1:3[3]. Number of pulleys and rope used in travelling block will be depend on the load it has to carry .Travelling box structure guides the rotary head to travel top to bottom. Its geometric model is created in CATIA Software and imported to hyper mesh for convergent Finite element mesh and analysis. Stress and displacement on travelling block are calculated by using ANSYS software

II MODELLING

CATIA is a robust application that enables us to create rich and complex designs and we use fundamental skills and concepts that enable us to create a solid foundation for our designs so we have created traveling block by using this software

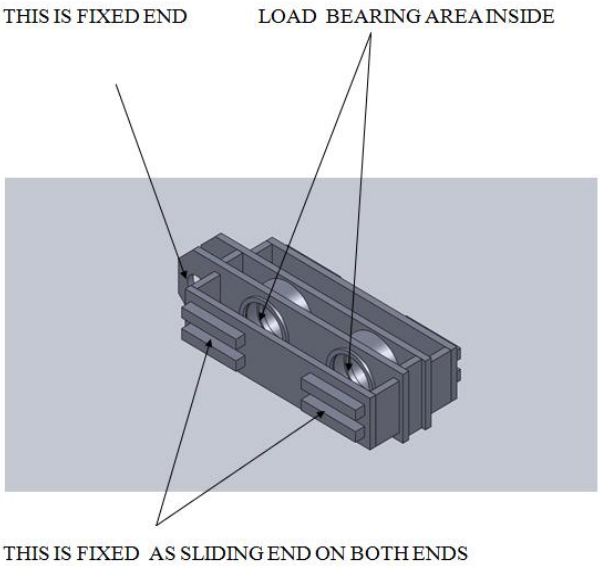

Fig 1: Travelling *block*

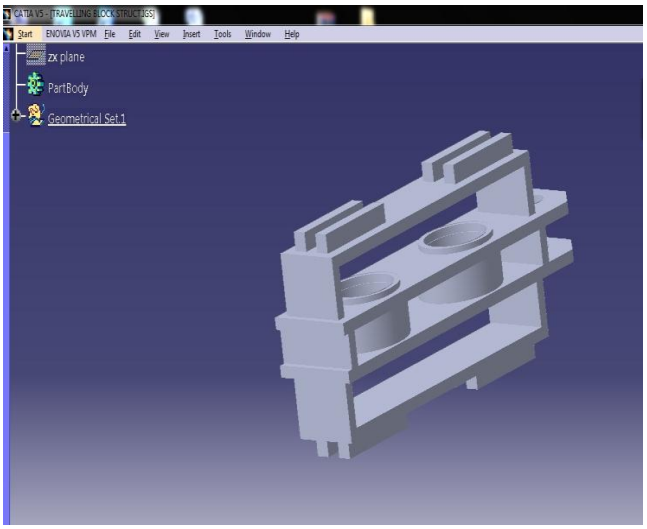

Fig 2: Isometric view

III MESHING

Meshing is generated by using hyper mesh software. Mesh the geometry by using tetra-hedral elements. Element type is solid 45

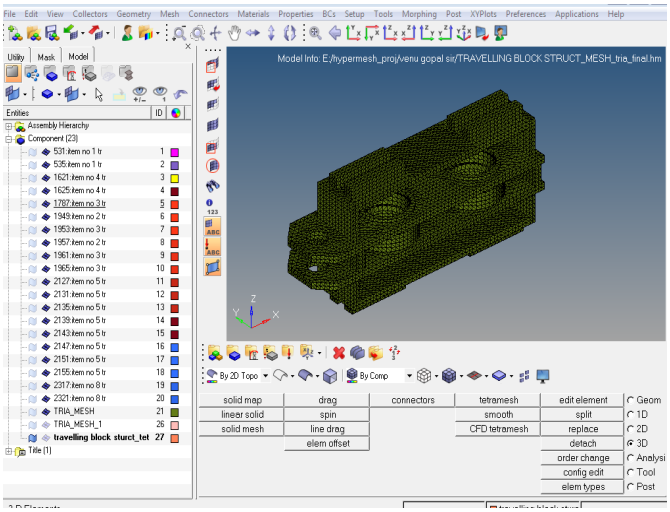

Fig 3: Mesh model of a travelling block

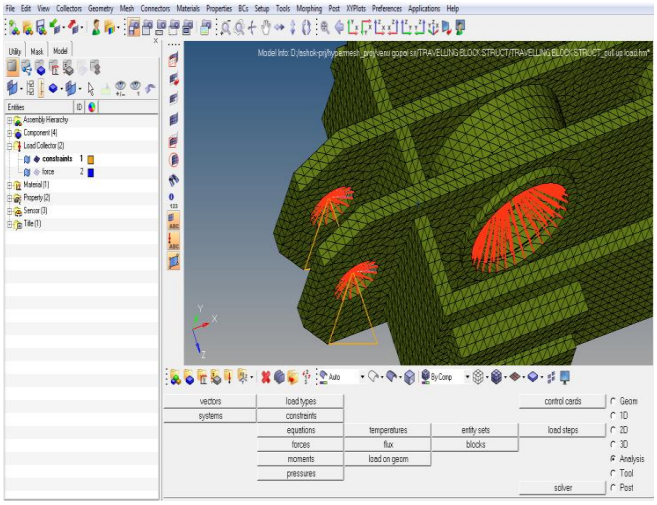

Fig 4: constrained model of a travelling block

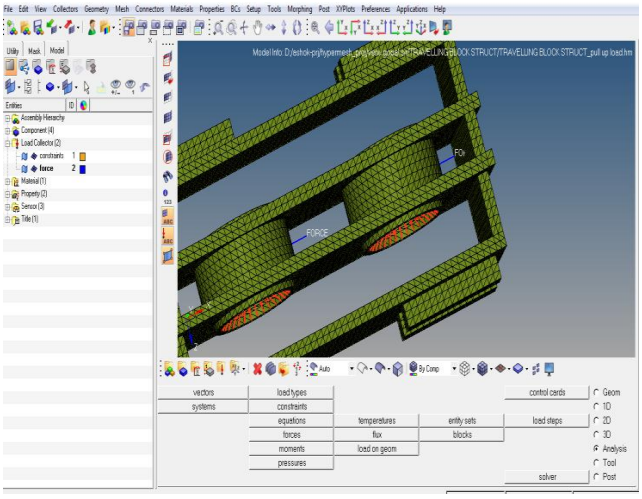

Fig 5: loading condition of a travelling block

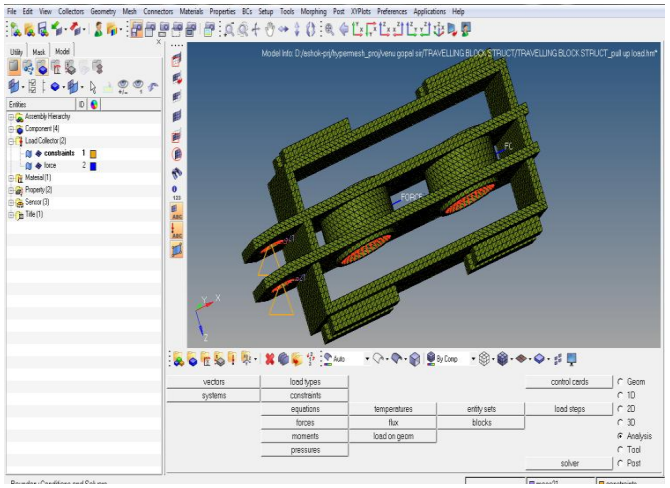

Fig 6: Constrained and load condition of a travelling block

IV ANALYSIS

The primary objective of a structure is to carry and transmit loads to foundations safely and to perform well in a serviceable condition and it should have acceptable low probability of damage. The model has been taken into ANSYS applied its material properties as follow

TABLE I. MATERIAL PROPERTIES

Material	*Young's modulus(N/mm2)*	*Poisson's ratio*	*Density (ton/mm3)*
Steel	2.1e5	0.3	7.89e-9

V RESULTS OF ANALYSIS

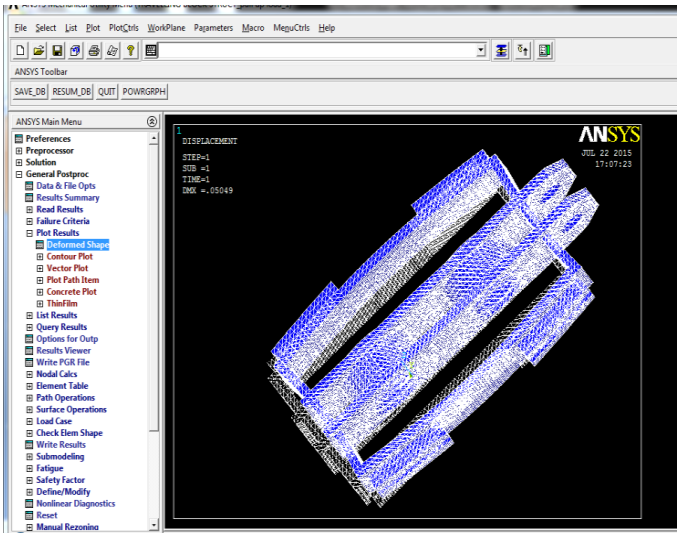

Fig 7: Deformed-un deformed shape of a travelling block

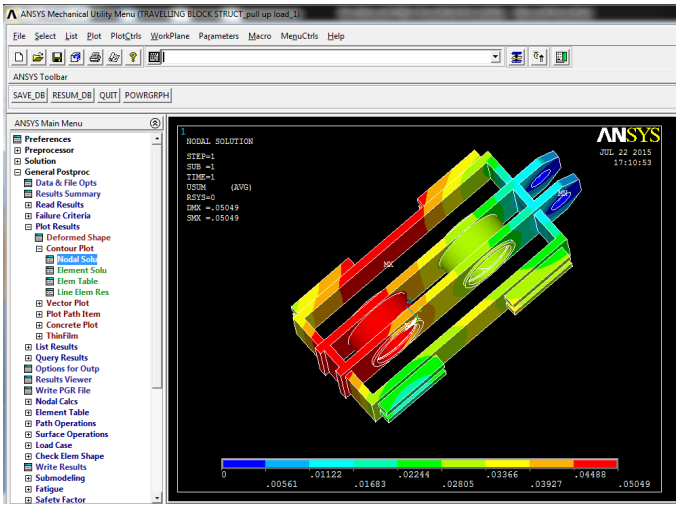

Fig 8: Displacement vector sum of a travelling block

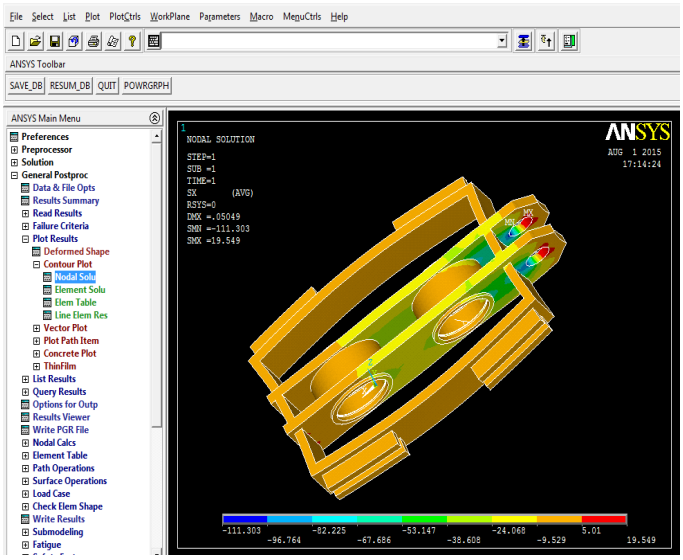

Fig 9: Stress in X-direction of a travelling block

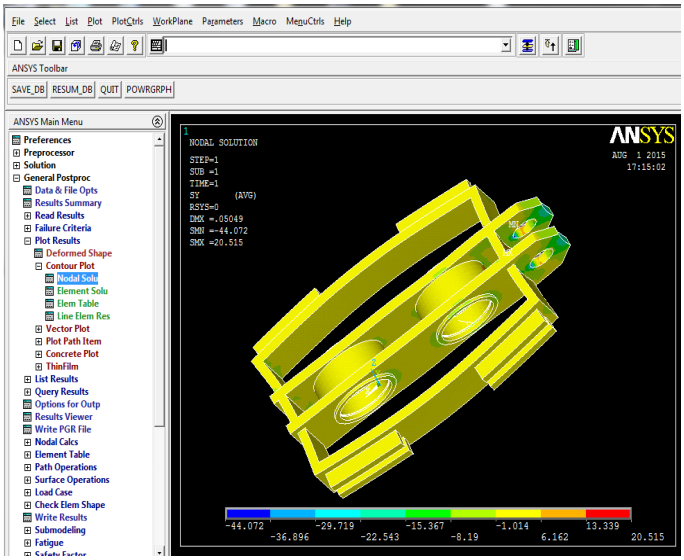

Fig 10: Stress in Y-direction of a travelling block

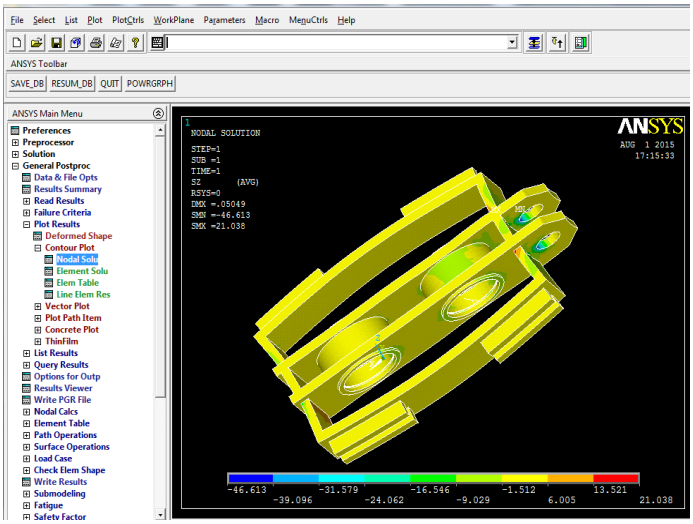

Fig 11: Stress in Z-direction of a travelling block

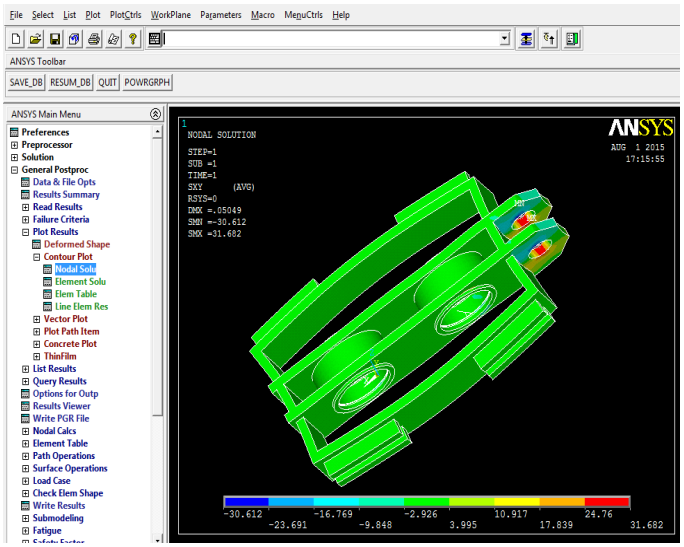

Fig 12: XY-shear stress of a travelling block

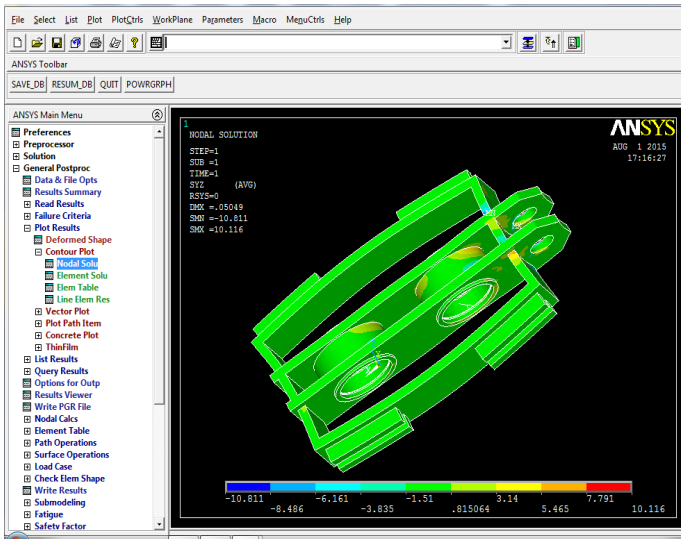

Fig 13: YZ-shear stress of a travelling block

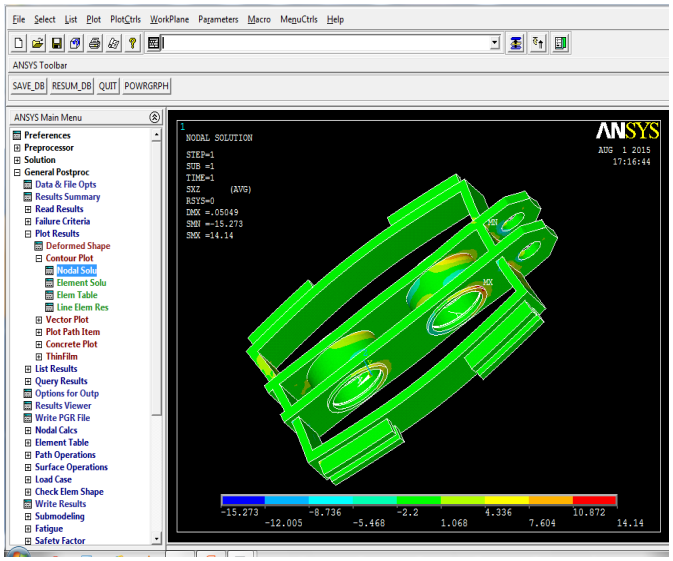

Fig 14: XZ-shear stress of a travelling block

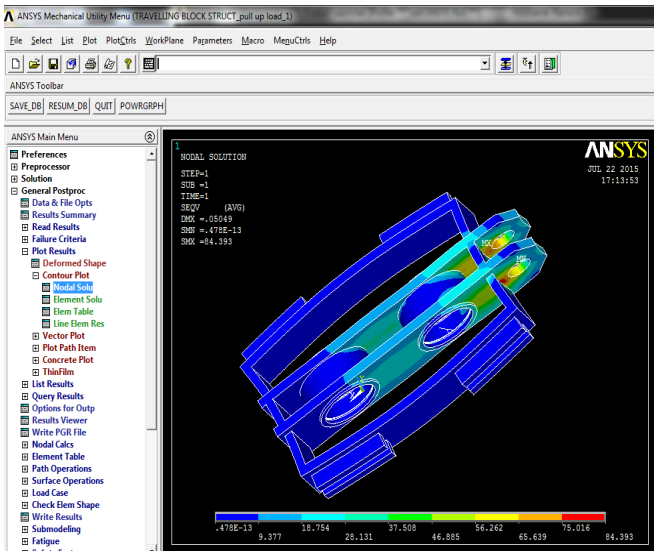

Fig 15: von-misses stress of a travelling block

TABLE II. RESULTS

S.no	Name	value
1	Displacement	0.05mm
2	Stress in X-direction	19.54 N/mm2
3	Stress in Y-direction	20.51 N/mm2
4	Stress in Z-direction	21.03 N/mm2
5	Shear stress in XY-direction	31.68 N/mm2
6	Shear stress in YZ-direction	10.11 N/mm2
7	Shear stress in ZX-direction	14.14 N/mm2
8	Von-misses stress	84.39 N/mm2

VI CONCLUSION

The Travelling block was analyzed by finite element methods. From the above results the Maximum Von-misses stress observed is 84.39N/mm2. This value is under safe load condition. The Maximum Displacement for travelling block observed is 0.0504 mm, which can be omitted for very small values. The Stress Levels for travelling block was checked under max load condition with load of 11,500Kg (i.e. 112776 N) and proved to be safe design and suggested to use for drilling rig operations and also for Heavy Engineering Equipments.

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