International Journal of Engineering Technology and Scientific Innovation

ISSN: 2456-1851

Volume:02, Issue:01

SIMULATION CONNECTING TRUSSES MODEL UNDER THE EFFECT OF AXIAL TENSILE STRENGHT

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ABSTRACT

In this research was to study ways to connect the trusses by simulating analytical model representing with Finite Element Method by using the computer program Solidwork 2013. Three models were studied to connect the trusses The first model is the link by welding the second model is linked by bolts and model the third link by bolts and welding . It was the end of the installation of one of the parties and to shed load axial strain amount (30KN). Used Pin / bolt Check feature and advantage Weld Check plot to learn the proper diameter bolt which (M20*2.5) and the thickness of welding required (10mm).

It was calculated stresses and displacements of the three models and compare them turned out to be less stress and displacement when the method of connecting trusses by welding (20MP, $3.62*10^{-2}$mm) and the highest value when linked by bolts (293MP, $4.91*10^{-2}$mm) either in the case of connecting bolt and welding the values (187MP, $4.04 * 10^{-2}$mm). Note that in addition to the welding area connectivity bolts led to lower stress on linking the region as well as to increase the force of Friction bolts, leading to an increase in the strength of the installation area connectivity.

It was also a study represented the welding area as ((Beam using weldment-Fillet Bead feature and calculate the axial and bending as affected by the presence of the bolts holes where the value (11.4MP) when he was linked by welding only either when it became linked welding stresses Axial and bending to (20.2MP).

In the end determine how either of them would be the best of the link to be performed? What distinguishes the metal structures are easily jaw and installation when needed and this happens only when the installation and bolts increased value by bolts and screws so that if used welding facility metal and you know that you will need to move you know a big mistake because you need to break the iron, but with nails, screws may just disassemble and move the metal bridges and columns to the new place after its processing rules and the composition.

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But if you will commends the permanent establishment and you know it welding course is considered stronger than the bolts in strength and assume moments so that makes moments and forces acting pass from a member to another member like a member of one of these is an advantage welding. It is determined best as if it intended to transfer mineral facility must be used screws and nails in all joints but if the facility will be built to get lost and transported only a matter of constructional design so if you see a clip requires a lot number of the screws is better done welding to ensure no perforation member of bolts are many holes and that lead to a weakening of the entire user interfaces in the area.

Keywords: trusses, simulating analytical model, axial tensile strenght, finite element method

INTRODUCTION

There are three types of mineral associations with links to some of them.

1. rivets Rivets rivets used to bind iron sectors together. And the type of rivet common use is the same stalk and head ball (Snap Head).

2. fastening bolt and Nuts Bolts made of black wrought iron (Mild steel Black Bolts) is used in linking iron sectors of the site.

3. Welding seams are considered more roads uses to connect with each iron facilities at the present time. And using the terms and conditions especially like used in the specification American Welding Authority (American Welding Society).[1]

What distinguishes the metal structures are easily jaw and installation when needed and this happens only when the installation by bolts and screws so that if used welding facility metal and you know that you will need to move you work a mistake big because you need to break the iron, but with nails, screws can only disassemble and transport metal bridges and columns to the new place after its processing rules and the installation But if you will commends the permanent establishment and you know it weld course is considered stronger than the bolts in strength and assume moments so that makes moments and forces acting pass from a member to another member like a member of one of these is an advantage Welding.

He also notes that he is using this method in the case of connecting parts of different metals or non-metallic parts of the non-welding or parts do not bear temperature welding [2]

Welding method is the most widely used and most effective way of metal constructions and their advantages:

- Ensure continuity in the metal sectors
- Give a resistance equal to or greater than the resistance in the metal sectors
- Good resistance to temperature

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changes and climatic conditions

While The bolts way it gives ease of installation and jaw in the workplace (cruise).

In the latter method is the rivet of the first roads that were used in the connections between the metal segments and now is lighthearted limited use in some countries .[3]

THEORETICAL FRAMEWORK

Trusses: Method of Joints.

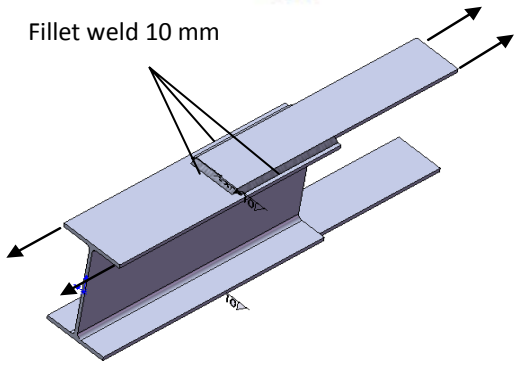
In some cases we find that tensile members in the trusses identical about assembly panels and be the tensile stresses are evenly distributed on section.

To design tensile members.

***1- In the Case of Joints by Weld* [4]**

- Determine pregnancy, let it **T**
- Calculate the Sectional Area

$$A_{req} = \frac{T}{f_{pt}}$$



Whereas:

f_{pt} :Tensile Stress Allowed

T:Tensile strength

A_{reg}: Sectional Area

- Select the member from table based on Sectional Area (A_{reg}).
- See the real stresses (f_{act})

$$f_{act} = \frac{T}{A} \leq f_{pt}$$

2-In the Case of joint by Bolt [4]

- Determine pregnancy ,let it **T**
- Calculate the Sectional Area
- Select the member from table based on Sectional Area (A_{gross})
- See the real stresses (f_{act})

$$A_{gross} = \frac{T}{0.85\ f_{pt}}$$

Where:

A_{net}: Net Sectional Area which area after discount bolts holes space

$$A_{net} = 0.85 \quad A_{gross}$$

A_{gross}: Net Sectional Area

Can be written the Net Sectional Area as follows

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$$A_{net} = A_{gross} - A_{\varphi}$$

$$A_{net} = A_{gross} - d.t$$

Where

d: bolt diameter, t: thickness plate

$$f_{act} \leq f_{pt}$$

$$f_{act} = \frac{T}{A_{net}} \leq f_{pt}$$

Simulation Truss model and Result

1-Using Feature Weld Check plot in Solidwork

Initially choose weld size (10mm) the least from weld size the required in one side (8.5mm) and other side (9.5mm), (8.3mm), the program will be tested from weld check plot where they appear weld joint failed to make sure from the reliability of the program Use Code D1.1 of the American Welding community (AWS).show figure (1)

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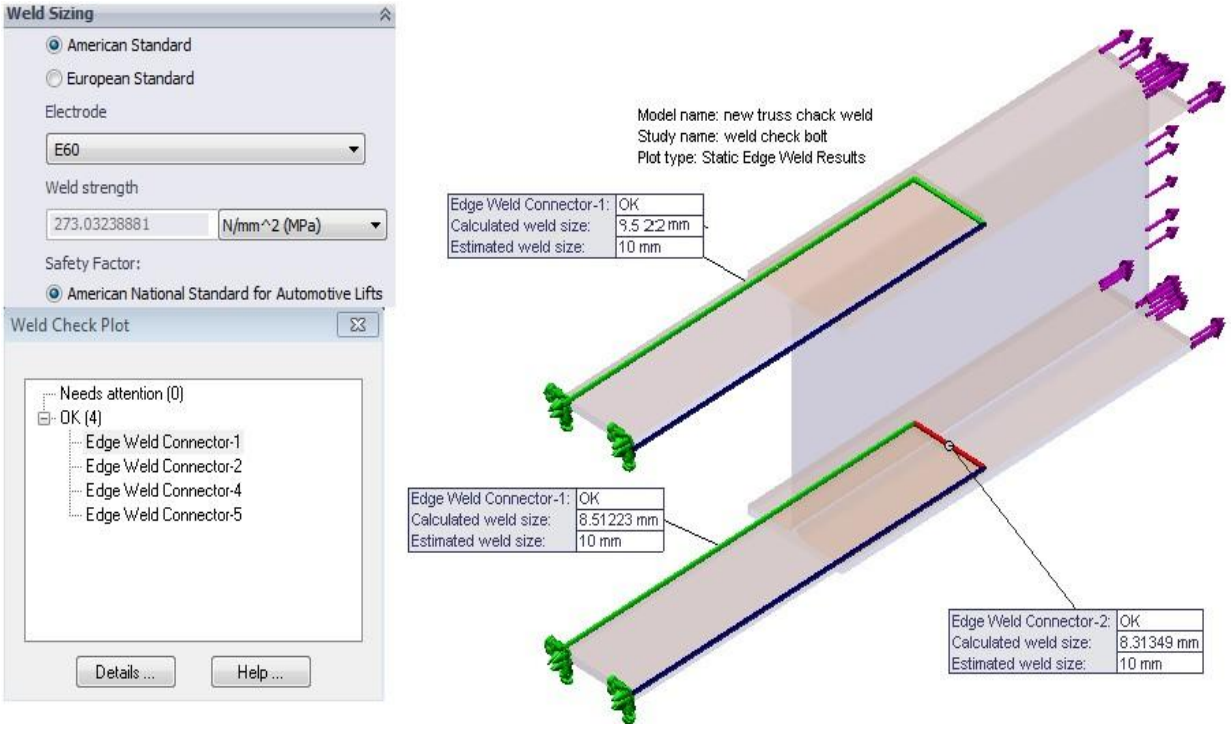

Figure (1): weld check plot

2- Using Feature Pin/bolt Check in Solidwork

Using Bolt M20*2.5

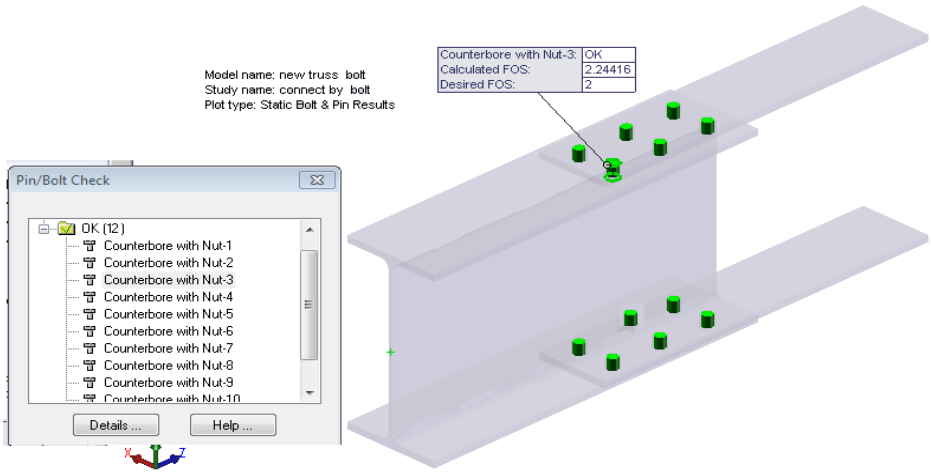

Figure (2): Pin/bolt Check

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After making sure of the design weld size and bolt diameter we rely on these values in simulation

Truss model by weld

welding has been put around the sides plate of a thickness (10mm) this values is calculated from feature Weld Check plot and Tensile strength (30kN) , figure (3) it illustrates the stage simulation

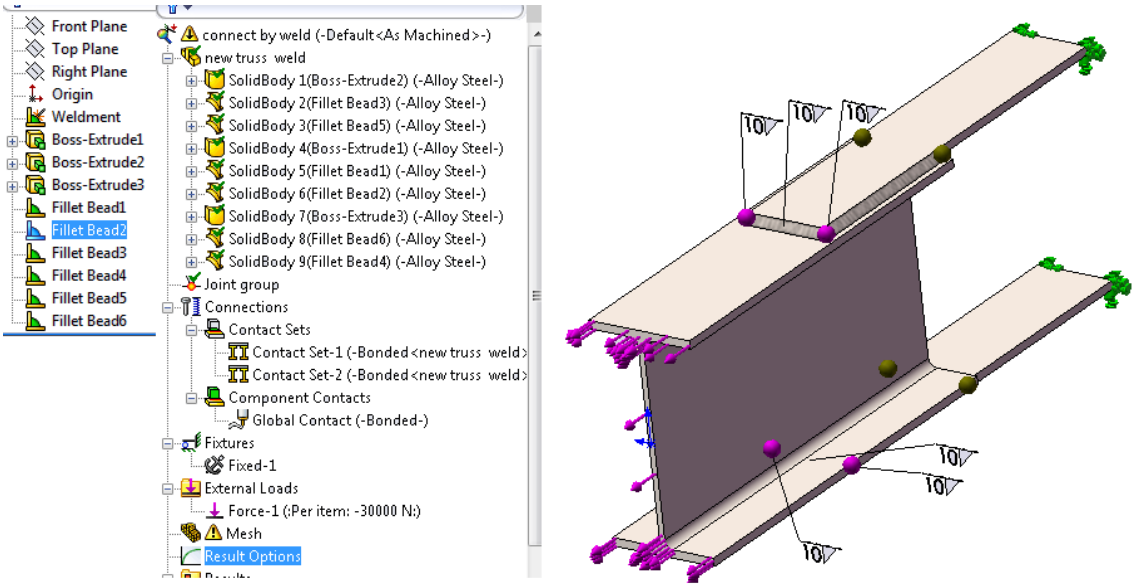

Figure 3: Stages simulation model by weld

Truss model by bolts

It was placed 6 bolt diameters M20 and pitch 2.5 Grad8.8 and introduced of all the information about bolt according to standard specifications and Tensile strength (30kN) shown in figure 4

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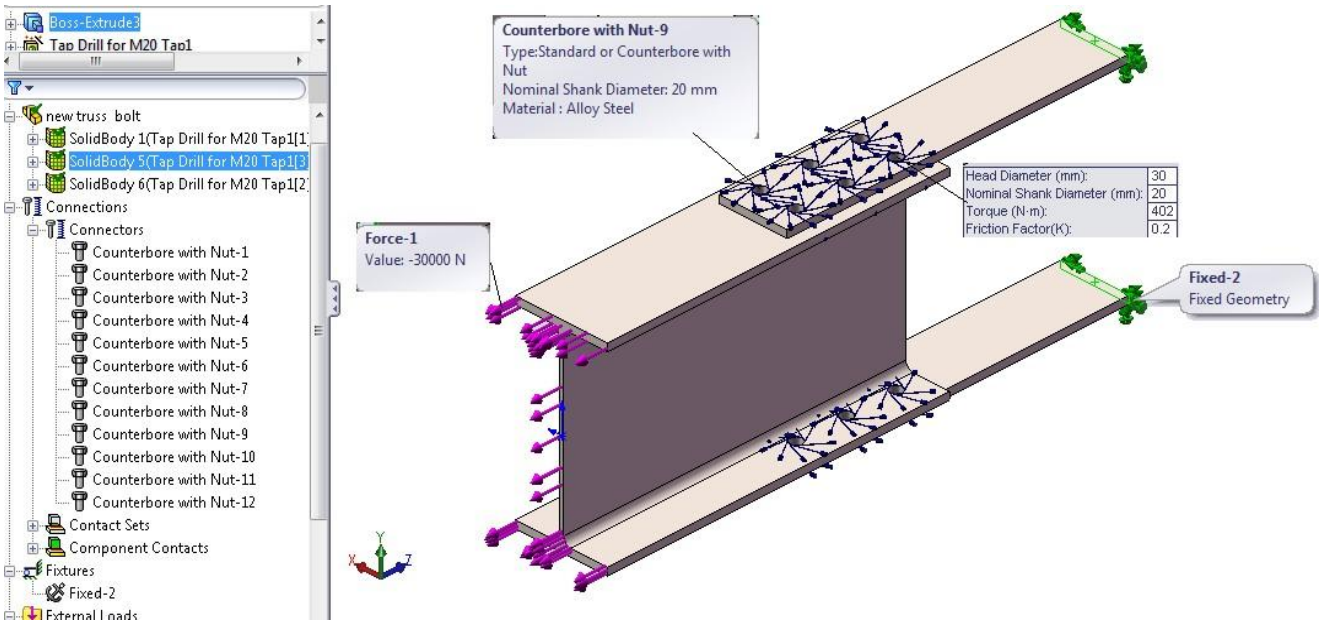

Figure 4: Stages simulation model by bolts

Truss model by bolts and weld

It has been linked trusses of use bolts and welding then simulation model shown in figure 5

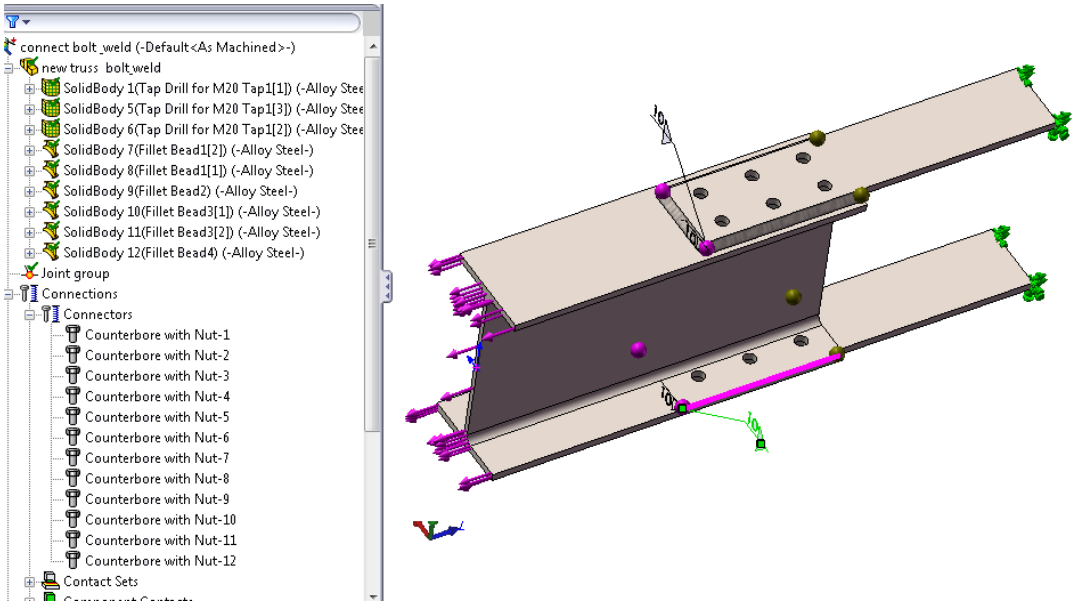

Figure 5: Stages simulation model by bolts and weld

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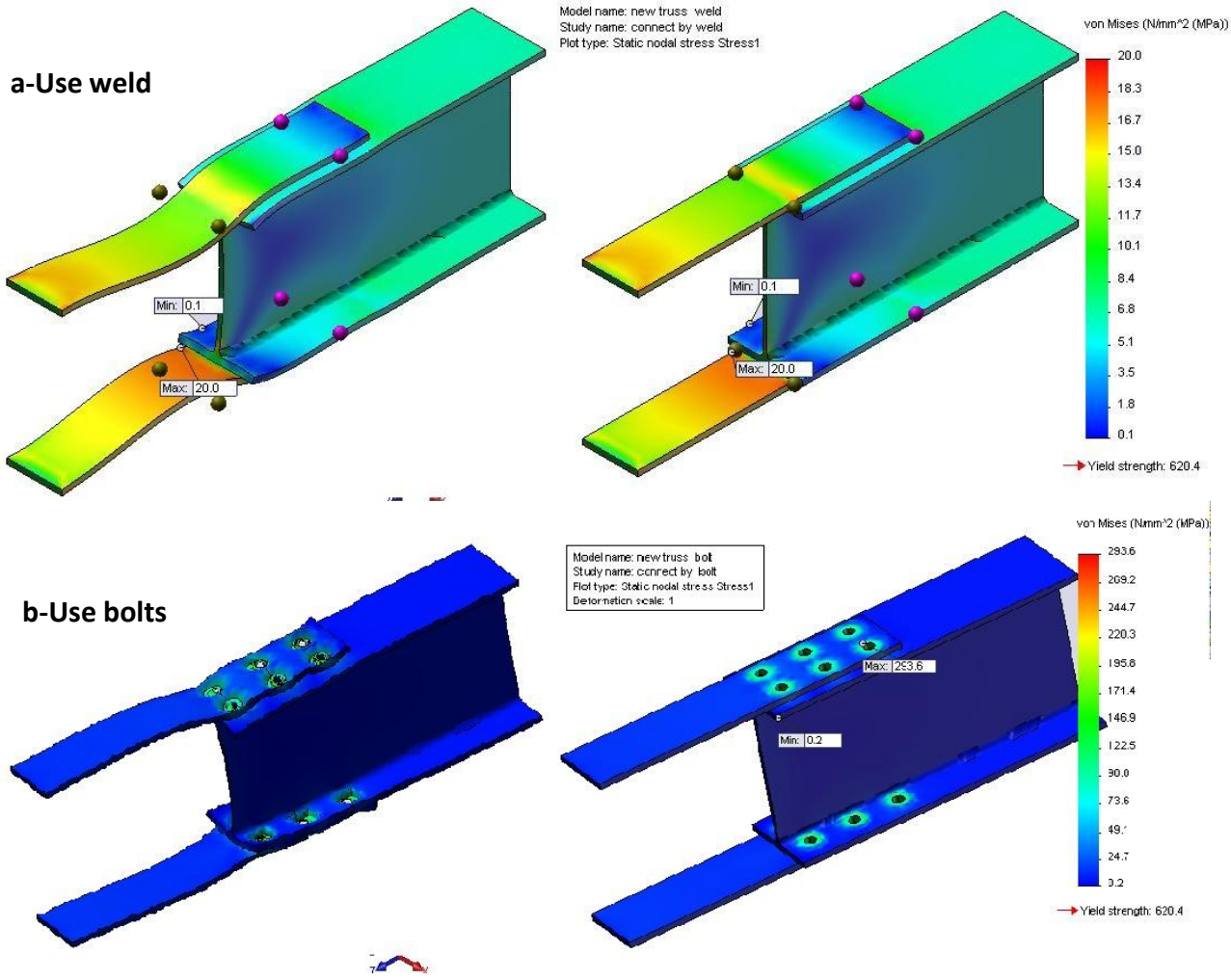
Note in figure 6 (a,b,c), stresses values generated in the truss in the case of use welding it was maximum value (20MP) while in the case of use bolts it was maximum value (293.6MP) and in case of use bolts and weld it was maximum value (187MP).



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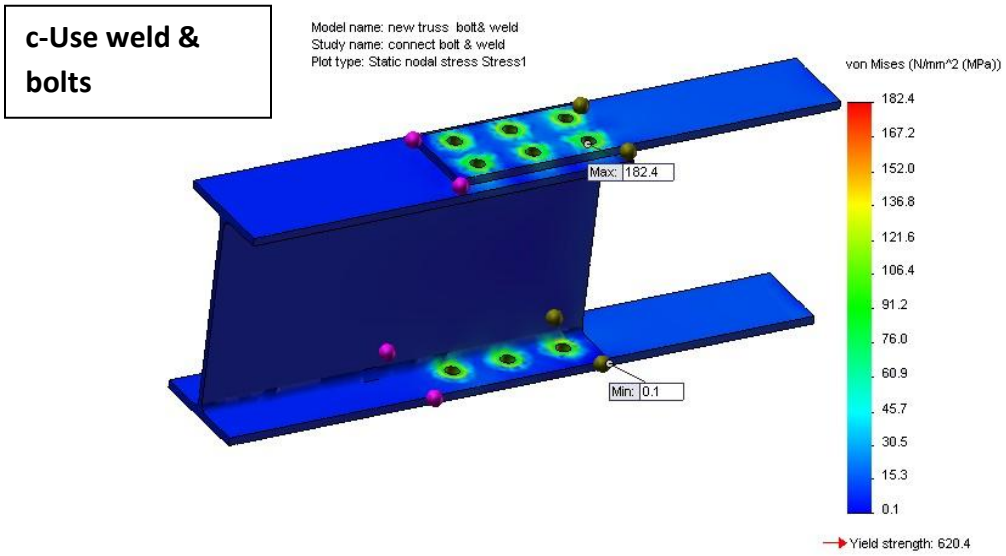
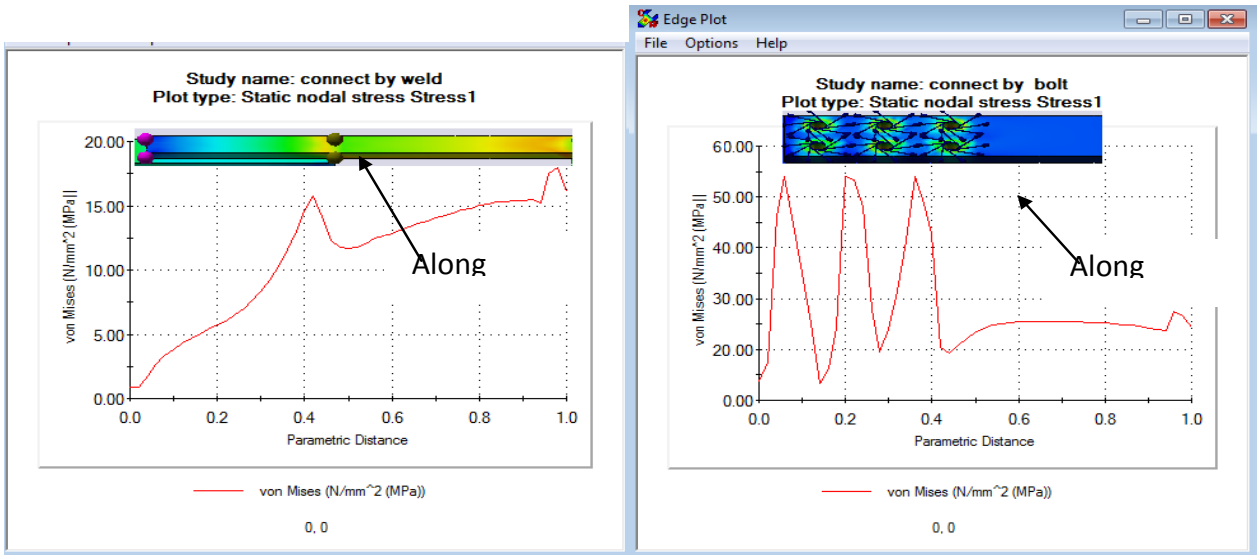


Figure 6 (a,b,c): show Von Mises in all cases

we note that the concentration of stresses the largest in the region that contains the holes bolts because these holes lead to a weakening region shown figure 6-b.

To reduce stress concentration has been added welding to the sides shown figure 6-c



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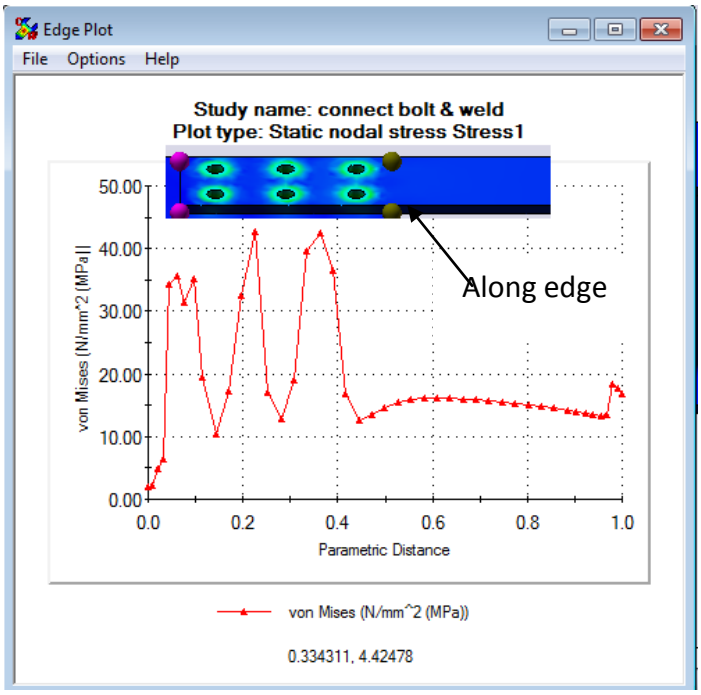

Figure (7): stress concentration along edge the connectivity area in each case

Note that lowest value of displacement in case connect by weld shown figure (8-a) while highest value in case connect by bolts shown figure (8-b) and less displacement value when you add welding them where welding works to strengthen the region as well as transmission and distribution of load on a regular basis shown figure (8-c) and figure (9-c).

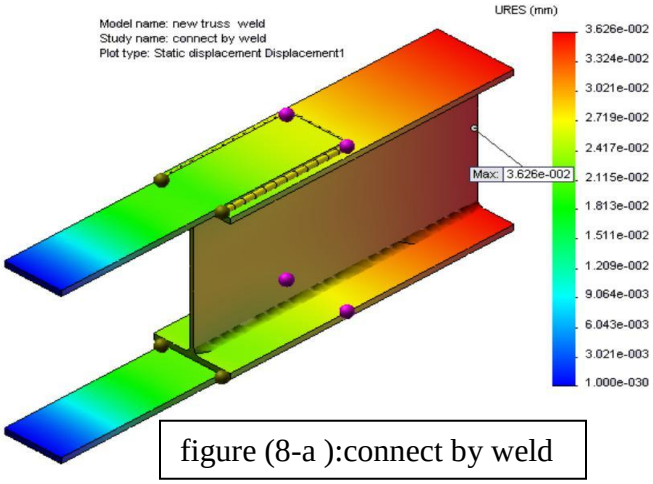

figure (8-a):connect by weld

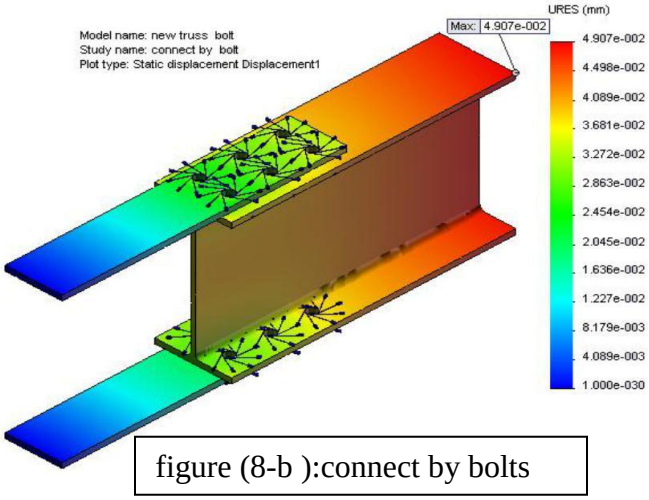

figure (8-b):connect by bolts

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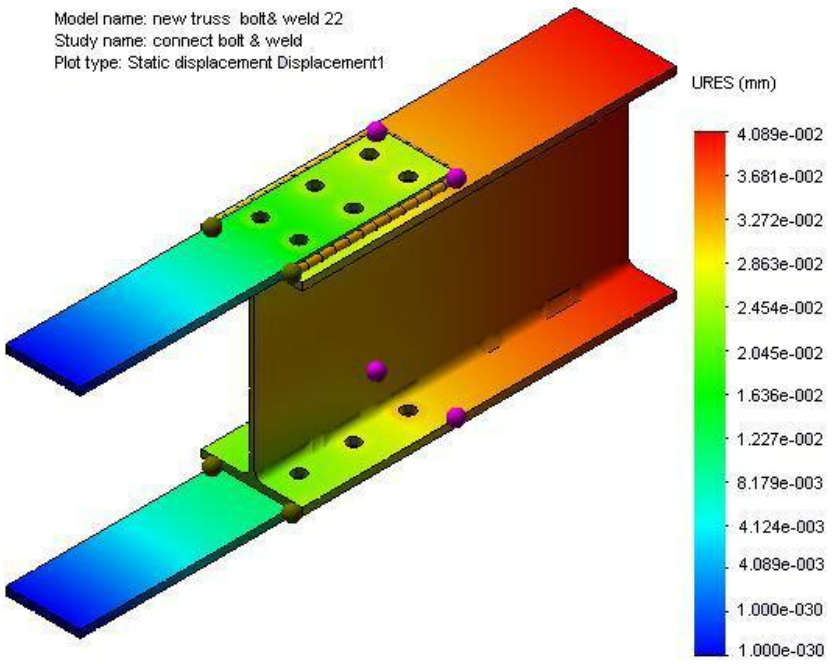
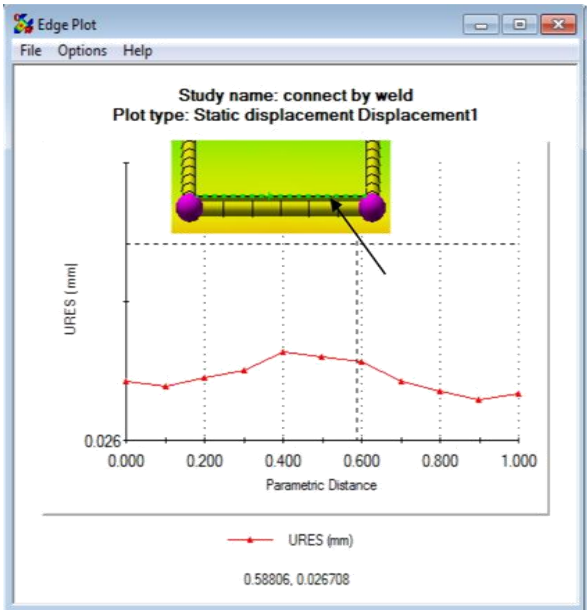


figure (8-c):connect by weld & bolts



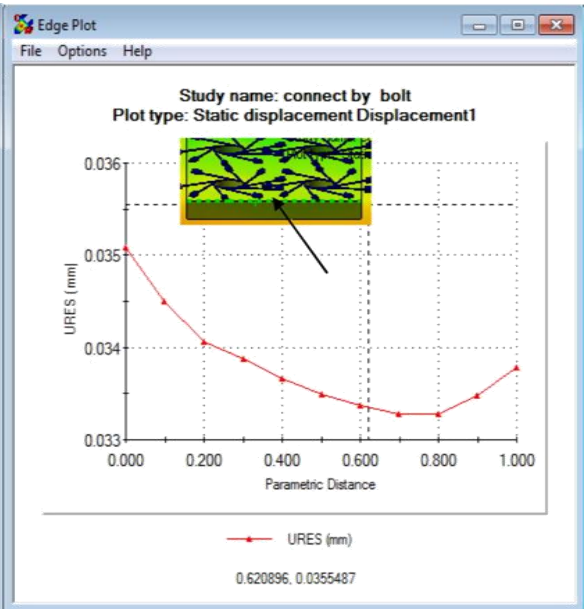


figure (9-a): connect by weld

figure (9-b): connect by bolts

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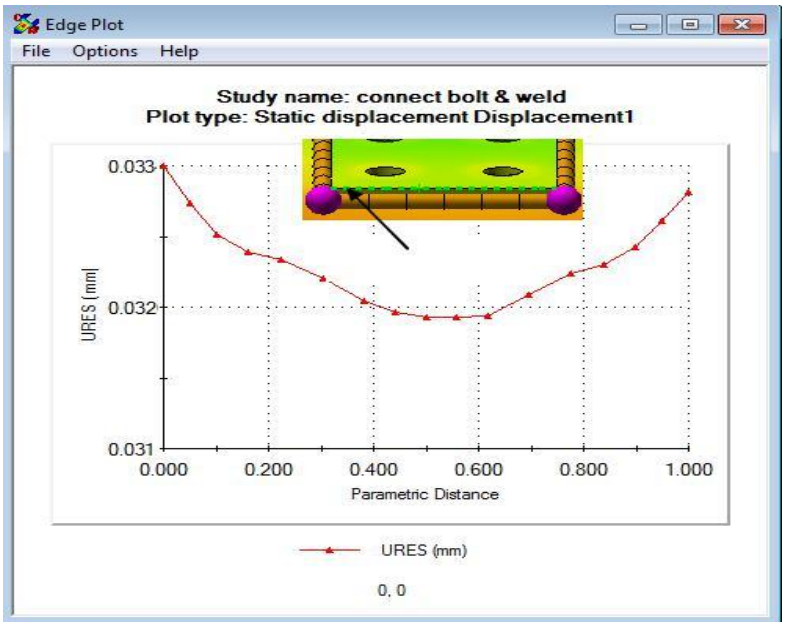

figure (9-c): connect by weld & bolts

figure (9):the distribution of displacement along edge for all cases

- Study welding area as Beam

Not the value of Axial and bending (11.4MP) shown in figure (10-a) while increasing the value of Axial and bending (20.2MP) shown in figure (10-b) because there are holes bolts lead to weakness of the region and the transmission of load to welding area.

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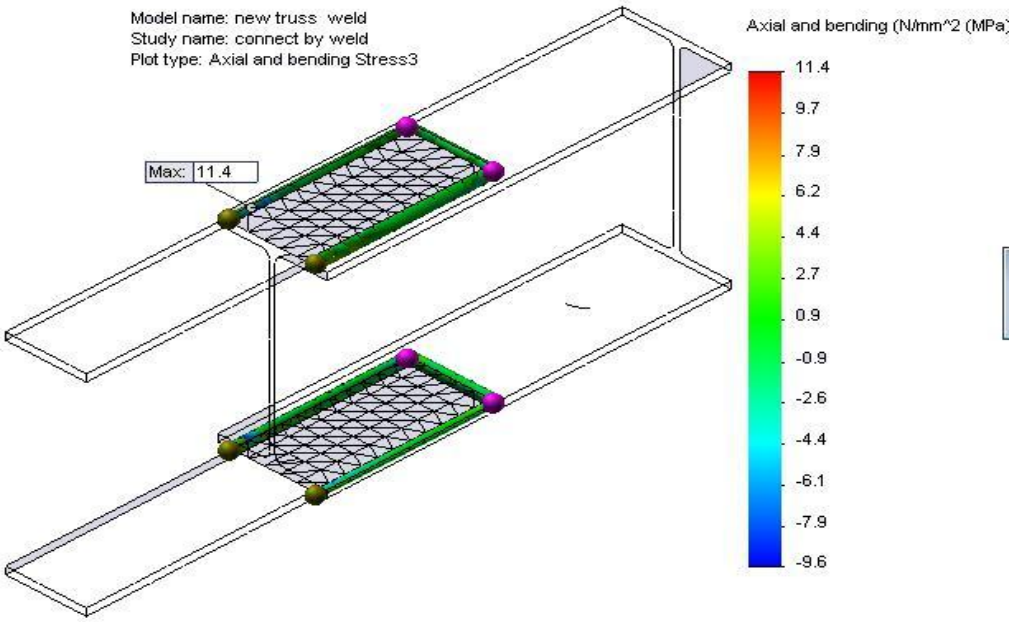

figure (10-a): the value of Axial and bending on welding area

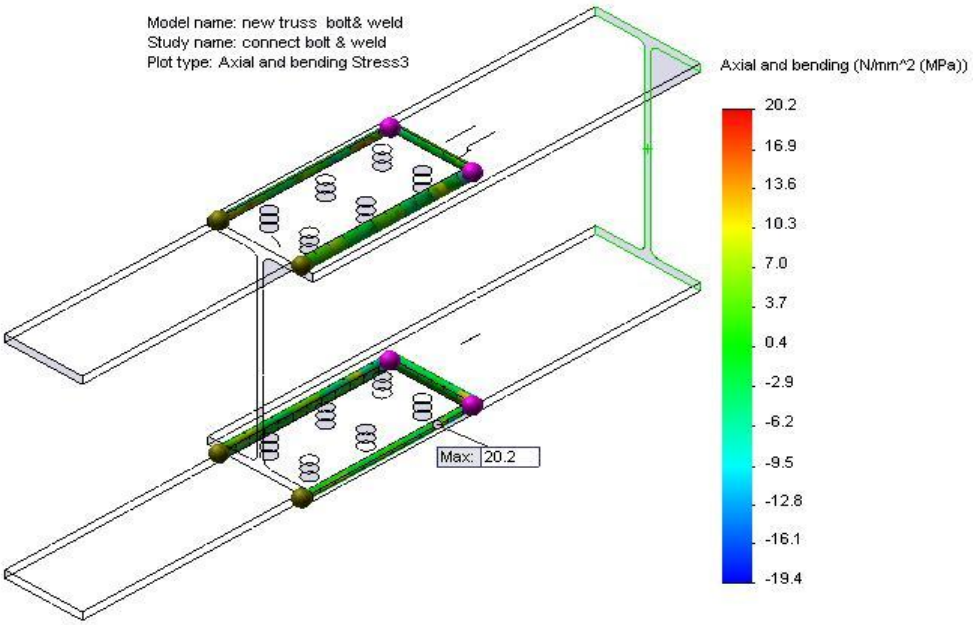

figure (10-b):Effect of the holes bolts on the value of Axial and bending in welding area

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The addition of welding to area connectivity ,in add to the bolt lead to an increase friction force of the bolt shown in figure (11-a),(11-b) ,this leads to an increase forces to install the bolt.

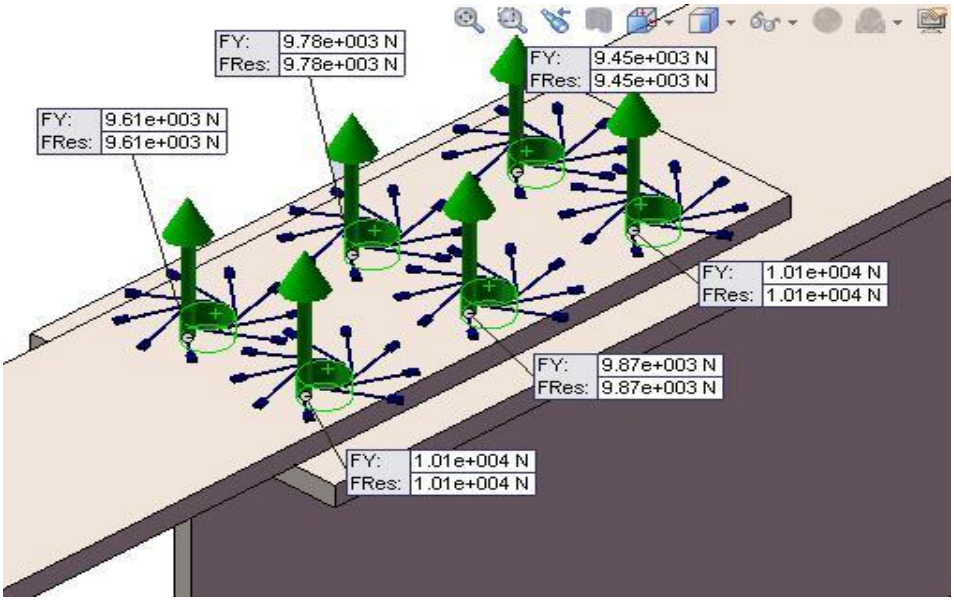

figure (11-a): friction force of the bolt

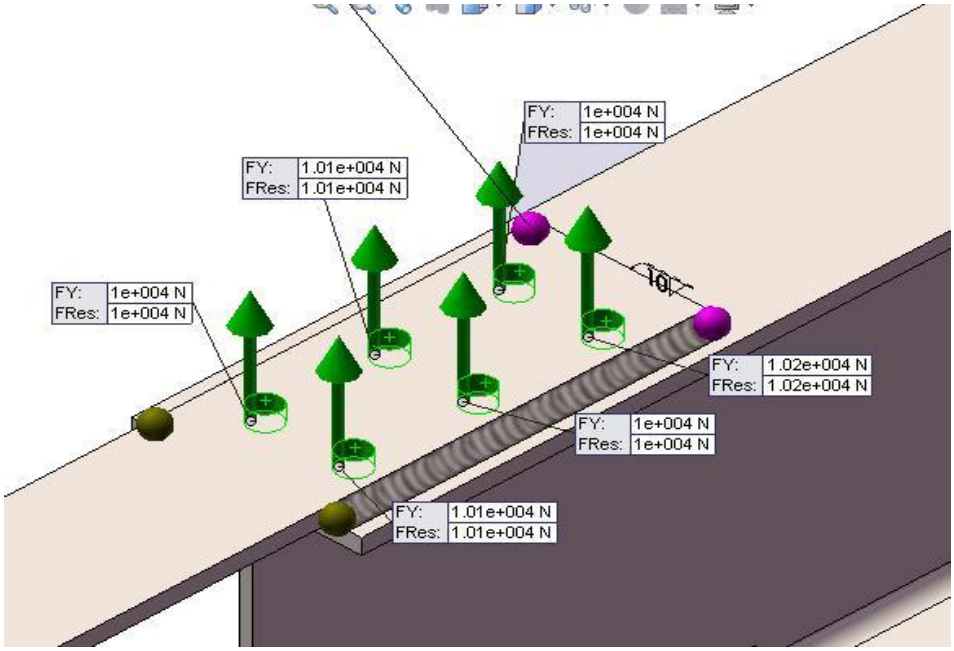

figure (11-b): friction force of the bolt with welding

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CONCLUSION

1. The stresses generated on truss in connecting area in the case using welding less than The stresses generated in the case using bolts.

2. The addition of welding to the connectivity area which contains on bolts lead to Decreasing the stress on the truss, as well as the addition of welding lead to Increase the frictional force of the bolt and this leads to increased installed linking area.

3. welding is considered stronger than the bolts in strength and assume moments so that makes moments and forces acting pass from a member to another member like a member of one of these is an advantage welding. It is determined best as if it intended to transfer mineral facility must be used screws and nails in all joints but if the facility will be built to get lost and transported only a matter of constructional design so if you see a clip requires a lot number of the bolt is better done welding to ensure no perforation member of bolts are many holes and that lead to a weakening of the entire user interfaces in the area.

4. Welded of construction generally lighter constructions and bolted the economic side, the materials used due to the lack of need for assembly plates or other materials arrived Unlike bolted joints where there are perforated holes reduce the effective size of the space, while at the welding takes full sectional area

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