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# Prediction of Stresses during Spot Welding Process by Optimizing Nugget Diameter by Finite Element Method

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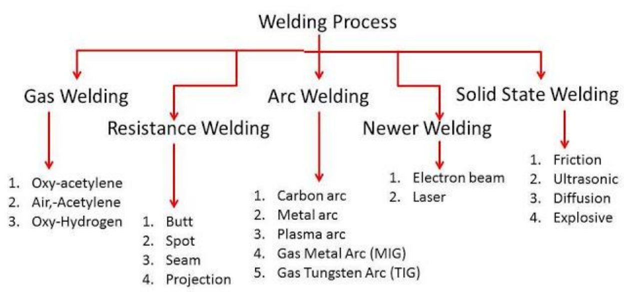
***Abstract*—In present investigation numerical simulation is performed in spot welding of steel plate with different nugget diameter to predict stress effect at constant load by finite element method. The applied boundary condition are validated with previous research work, the present analysis stress and strain results are closed to validation result.**

***Keywords*— Spot Welding, Nugget size, Deformation, Vonmises Stress.**

## I. INTRODUCTION

Welding is a permanent joining process used to join different materials like metals, alloys or plastics, together at their contacting surfaces by application of heat and or pressure. During welding, the work-pieces to be joined are melted at the interface and after solidification a permanent joint can be finished. Sometimes a filler material is brought to shape a weld pool of molten fabric which after solidification gives a robust bond among the materials. Weld ability of a material relies upon on various factors like the metallurgical adjustments that arise all through welding, modifications in hardness in weld quarter because of speedy solidification, extent of oxidation due to reaction of materials with atmospheric oxygen and tendency of crack formation in the joint position.



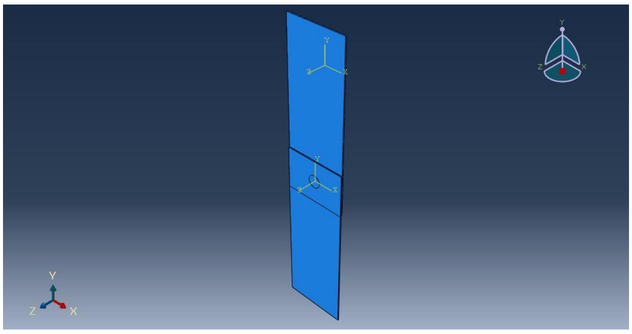

## II. TYPES OF WELDING CURRENT USED IN TIG WELDING

- DCSP (Direct Current Straight Polarity): In this type of TIG welding direct Cutting-edge is used. Tungsten electrode is attached to the bad terminal of energy deliver. This type of connection is the maximum common and widely used DC welding manner. With the tungsten being related to the negative terminal it'll most effective get hold of 30% of the welding energy (warmness). The resulting weld indicates precise penetration and a narrow profile.
- DCRP (Direct Current Reverse Polarity): In this type of TIG Welding placing tungsten electrode is connected to the high-quality terminal of electricity supply. This type of connection is used very rarely due to the fact most warmness is at the tungsten, consequently the tungsten can without difficulty overheat and burn away. DCRP produces a shallow, extensive profile and is mainly used on very light material at low Amp.
- AC (Alternating Current): It is the preferred welding current for most white metals, e.g. aluminium and magnesium. The warmness enter to the tungsten is averaged out because the AC wave passes from one side of the wave to the alternative. On the 1/2 cycle, where the tungsten electrode is wonderful, electrons will float from base material to the tungsten. This will bring about the lifting of any oxide pores and skin on the bottom material. This aspect of the wave shape is called the cleaning half of. As the wave actions to the point in which the tungsten electrode becomes terrible the electrons will drift from the welding tungsten electrode to the bottom material. This side of the cycle is called the penetration half of the AC wave forms.
- Alternating Current with Square Wave: With the advent of contemporary power AC welding machines can now be produced with a wave form known as Square Wave. The rectangular wave has higher manage and every aspect of the wave can provide a more cleaning half of the welding cycle and more penetration [2].

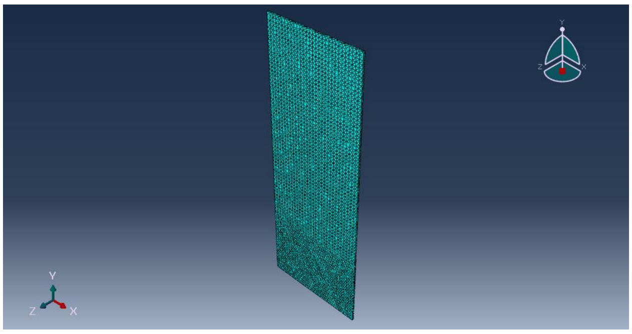
## III. METHODOLOGY

The procedure for solving the problem is

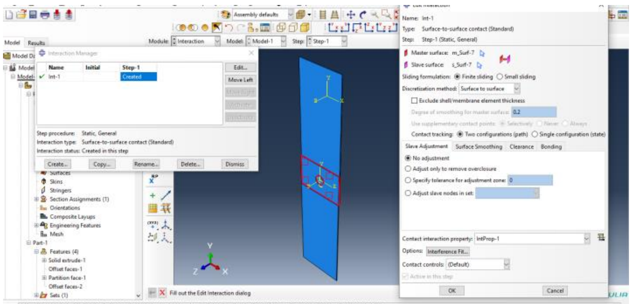
- Modeling of the geometry.
- Meshing of the domain.
- Defining the input parameters.
- Simulation of domain.



Modeling of the geometry



Meshing of the domain

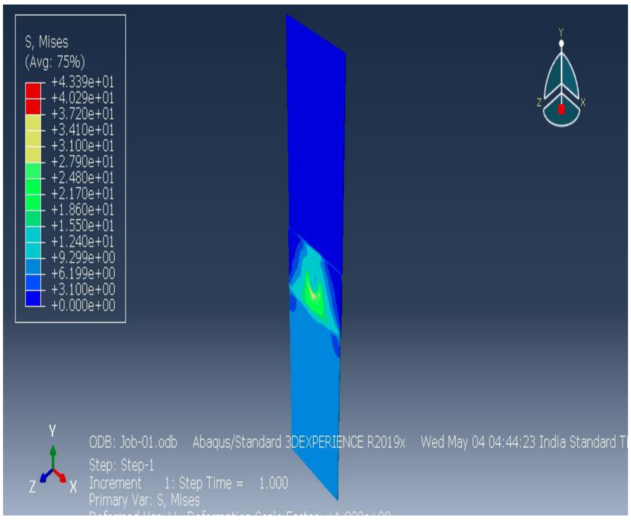


Defining the input parameters

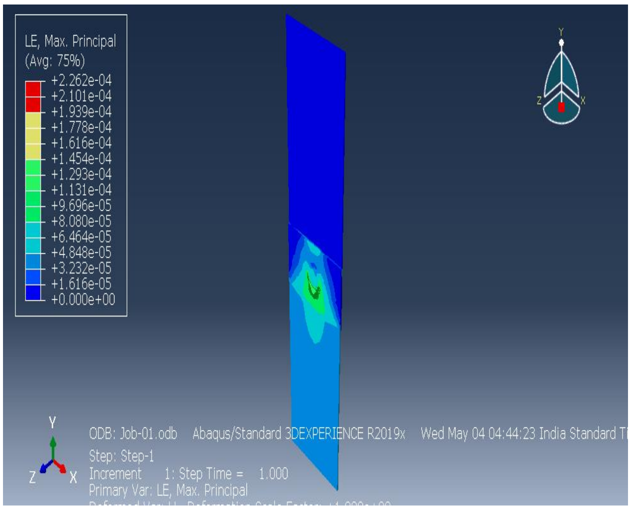
**Objective**

- To validate previous research work by evaluating it with finite element method.
- To optimize applied nugget for improvement in stress concentration.
- Parametric evaluation is to be performed for spot welding process.

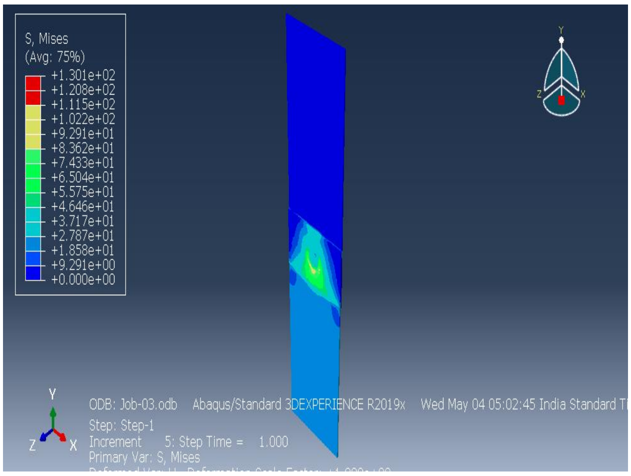
## IV. RESULTS



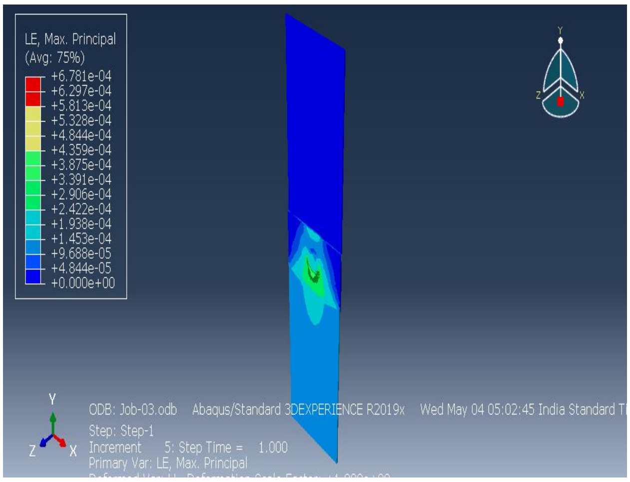

Vonmises stress for welded plate of nugget diameter 3.82 mm



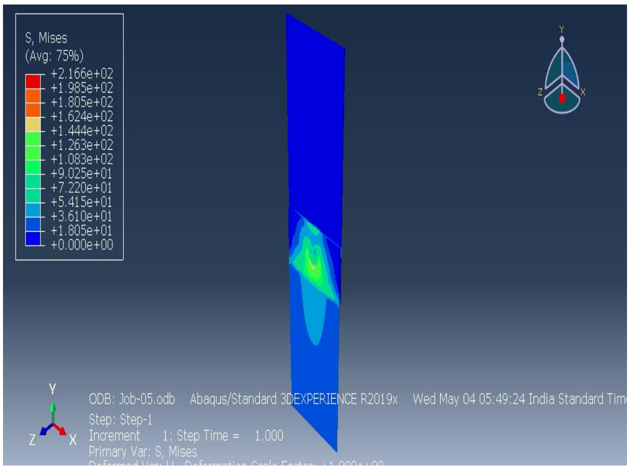

Linear strain for welded plate of nugget diameter 3.82 mm



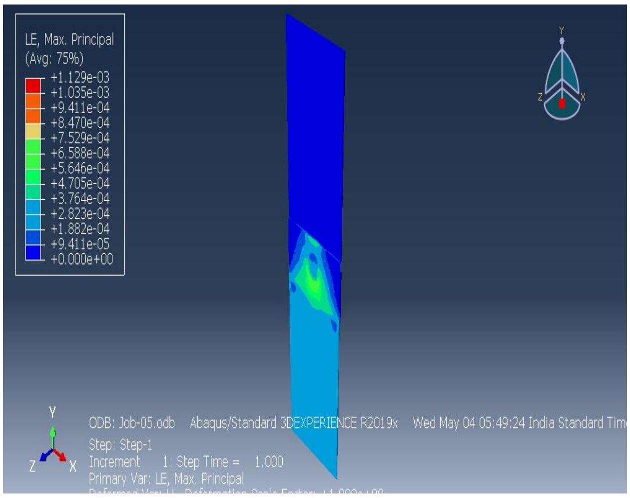
Vonmises stress for welded plate of nugget diameter 4.15 mm



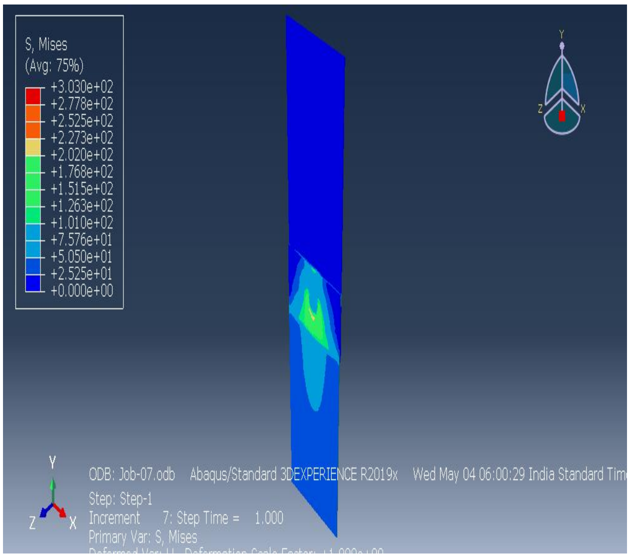

Linear strain for welded plate of nugget diameter 4.15 mm



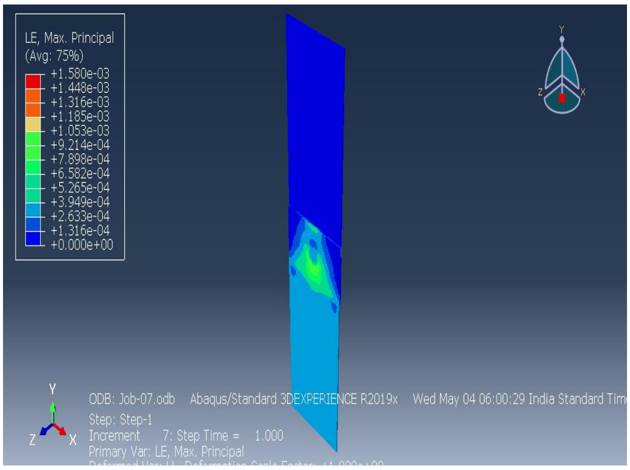

Vonmises stress for welded plate of nugget diameter 4.65 mm




Linear strain for welded plate of nugget diameter 4.65 mm




Vonmises stress for welded plate of nugget diameter 5 mm




Linear strain for welded plate of nugget diameter 5 mm

CONCLUSIONS

- The present investigation validates the FEM model with previous research work.
- It was observed that as nugget diameter is increased the stress was found to be minimum.
- The constant load with nugget diameter explores better relation in favor of stress and linear strain.

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