Computer Aided Design Software development for Welding hollow cylinder.

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Abstract: Software development is concerned with the conception, development and verification of a software system. This deals with identifying, defining, realizing and verifying the required characteristics of the resultant software. The software characteristics may include: functionality, reliability; maintainability, availability, testability, ease of use, portability and other. (Wikipedia, 2006). Today, joining metallic material using welding process is the most common method or ways of producing permanent joint for the production of machine parts, equipments and instruments. Welding is the process of joining metals or plastics together through the coalescences of the surface at the point of contact. CAD software for welding was developed using Microsoft Visual Basic.net which was used to weld two cylinders together automatically. The result clearly shows that Robotic welding systems are able to operate continuously, provided appropriate maintenance procedures are adhered to. Continuous production line interruptions can be minimized with proper robotic system design. Robotic welding is faster, error free and uniformly welded all through like that of the CAD welding model developed.
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Introduction

In the history of software engineering, the software engineering has evolved steadily from its founding days in the 1940s until today in the 2000s. Applications have evolved continuously. The ongoing goal to improve technologies and practices, seeks to improve the productivity of practitioners and the quality of applications to users. (Wikipedia 2004).

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Today, joining metallic material using welding process is the most common method or ways of producing permanent joint for the production of machine parts, equipment and instruments. Welding is the process of joining metals or plastics together through the coalescences of the surface at the point of contact. Coalescence is generally produced by heat, or pressure or a combination of the two and critical is often required to attain adequate bonding and weld strength without deterioration of material properties.

Robotics

Robotics is the engineering science and technology of robots, and their design, manufacture, application, and structural disposition. Robotics is related to electronics, mechanics, and software.[15] This makes a robotics a typical Mechatronics design.

CAD

CAD which means Computer Aided Design is used to represent the fundamental of drawing in Engineering. CAD can be applied to any system, one system may insert a line while another may create a line and a third system may model a line. One system may use a symbol while another may use a template, pattern, part or cell. More so, a software can also be developed for CAD welding. The increasing power of CAD has had a significant impact on the product development process, allowing improved quality, reduced cost, and aids products to get to market faster. CAD software is rapidly evolving into what might be better described as product development, or perhaps virtual prototyping software.

WELDING

Welding is one of the most widely used permanent joining technologies in assembly As with other manufacturing process, manufacturing feasibility and efficiency of weld components should be considered in the early part of design stages to avoid costly redesign and delay. While there has been considerable research interest in weldability assessment and predictive modeling of welding distortion. One significant reason for the current practice is the complexity involved in the decision and selection of feasible welding parameters.

Therefore, there is a great need for a methodology that can incorporate benefits from Concurrent Engineering (CE) concepts into weld design.

With the development of new techniques during the first half of the 20th century, welding replaced bolting and riveting in the construction of many types of structures, including bridges, buildings, and ships. It is also a basic process in the automotive and aircraft industries and in the manufacture of machinery. Along with soldering and brazing, it is essential in the production of virtually every manufacturing product involving metals.

The welding process best suited to joining two pieces of metal depends on the physical properties of the metals, the specific use to which they are applied, and the production facilities available. Welding processes are generally classified according to the sources of heat and pressure used.

The original pressure process was forge welding. Forge welding was practiced for centuries by blacksmiths and other artisans. The metals are brought to a suitable temperature in a furnace, and the weld is achieved by hammering or other mechanical pressure. Forge welding is used rarely in modern manufacturing.

The welding processes most commonly employed today include gas welding, arc welding, and resistance welding. Other joining processes include thermite welding, laser welding, and electron-beam welding.

Literature Review

The history of joining similar or dis-similar materials together was traced to the early eighteen century but well established in nineteen century. The most common welding practice during that period was Arc welding.

According to (Hewitt P.J, 2000) many different energy sources can be used for welding, including a gas flame, an electric arc, a Laser, an electron beam, friction and ultra sound. Welding can be done in space. Regardless of location, however welding remains dangerous and precautions must be taken to avoid burns, electric shock, poisonous fumes and over exposure to ultra violet light and these calls for need to use software for welding in order to minimize hazard.

Welding technology advanced quickly during the early 20th century as World War I and World War II drove the demand for reliable and inexpensive joining methods. Resistance welding was also developed. The discovery of acetylene was not practical until about 1900 when a suitable blow torch was developed. Oxyacetylene welding was largely replaced with arc welding and fell out of use for industrial application (Howard, 2005).

Shielding metal arc welding was developed during the 1980s using a flux content consumable electrode, and it quickly became the most popular metal arc welding process. In 1957, the flux-cored arc welding process deputed in which the self-shielded wire electrode could be used with automatic equipment. Later plasma arc welding, electro-slay welding and electro-gas welding were later invented (Gary and Scoff, 2005).

Material and Method

The cylinder was welded at an angle 90 degree to each other. The software was developed at Ladoke Akintola University of Technology Ogbomoso, Oyo State, and Microsoft visual basic.net was used to write the program.

The software that was developed has the ability to weld automatically using an example of gas welding.

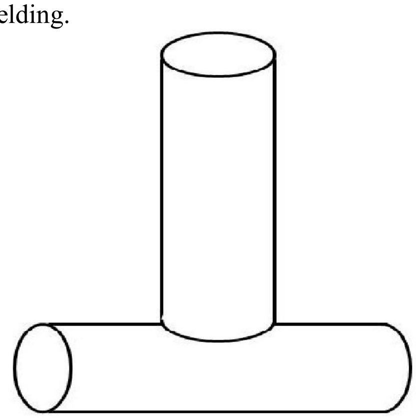


Figure 1 Cylinders placed at right angle
Source: The Author

The cylinders to be welded are as shown above.

Figure shows 2 fillet welding cylinder. Cylinder "A" is of specific diameter and length while cylinder "B" is also of a specific diameter and length. It is interesting to know that the dimensions can be varied and the positions can also be varied.

Manual Welding of Two Rods/pipes Placed at Right Angle Using Gas Welding

There are cylinders when the gas welding is about to take place. One of the cylinders contained oxygen gas while the other contained carbide with small quantity of water for reation to take place. The reaction inside the second cylinder produced acetylene and hydrogen. Therefore, the oxygen in the first cylinder mixed with the acetylene in the second cylinder to produce oxyacetylene gas with the help of regulators and valve guage attached to the end of the oxygen cylinder. The hoses from the two cylinders joined together at the nozzle with a regulator and one outlet. It is through this outlet that the two gases come out and the rate of flow is controlled by a regulator which takes place to produce oxyacetylene flame which is needed for welding. Two cylinders of the same thickness, and specified dimensions were placed at an angle 90 degree to each other. The first cylinder which is termed cylinder "A" was placed vertically at the mid centre of cylinder "B".

The flame was directed to the materials to be welded in this case the cylinder "A" and cylinder "B" was joined together with another thin metal that was introduced to the material welded. The temperature of the material welded was raised to a particular degree with the aid of the oxyacetylene flame and the welding rod was allowed to tough the welding zone whose temperature was being raised, its temperature was raised to the welding zone temperature as well.

Automatically, the welding rod was deposited on the materials being welded. When the area was cooled, the weld got formed automatically.

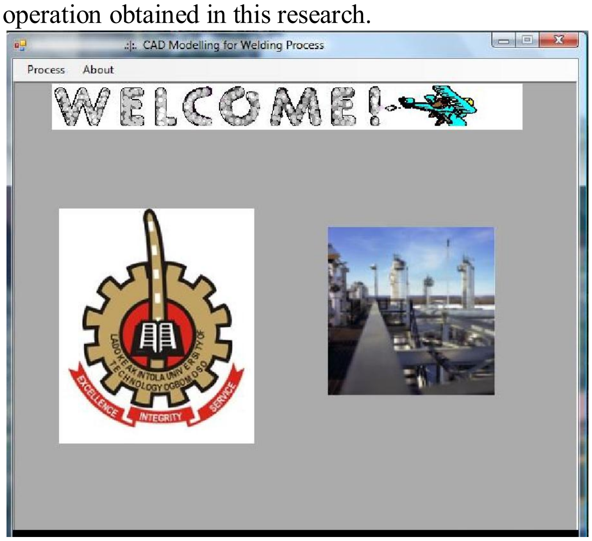
This design deals basically on welding along a circular pattern. The diameter of the material welded was given and the angle at which the welding took place was also given.

A software package was then determined using the parameters given (i.e the diameter and the angle of weld).

The welding operation was start with the setting of the weld gap (i.e the arch distance). Once this distance is set, the flow of weld begins. The gas starts following through the distance specified hence the welding operation was achieved.

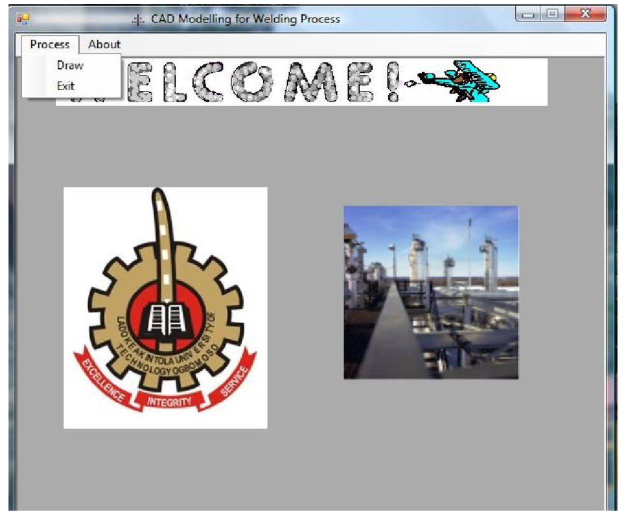
Results and Discussion

The following shows the sequence of welding operation obtained in this research.



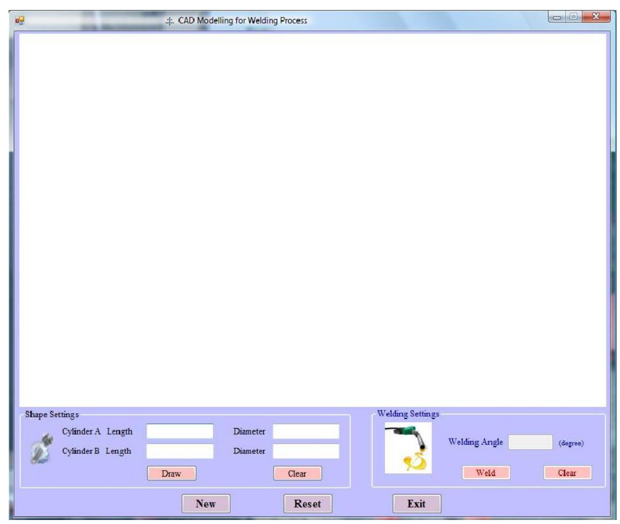
INTERFACE 1

The welcome interface of the research consist of the Process setting at top left corner which has the menu table that contain the process to be followed stepwise in order to achieve the expected result.



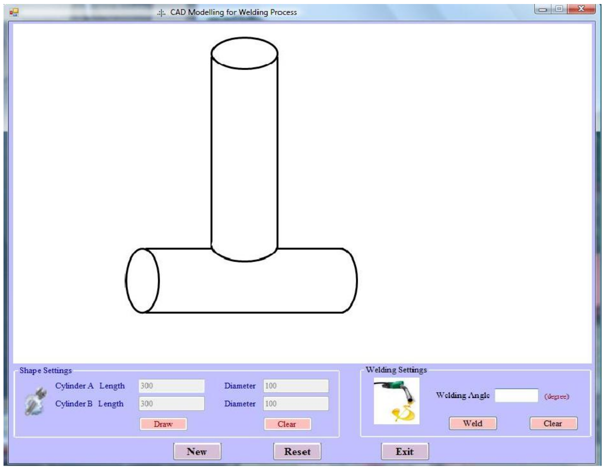
INTERFACE 2

Clicking the process bar in the interface would display Draw and Exit in descending order at the Task bar. For example, clicking Draw, will display another interface and clicking Exit will exit the application.



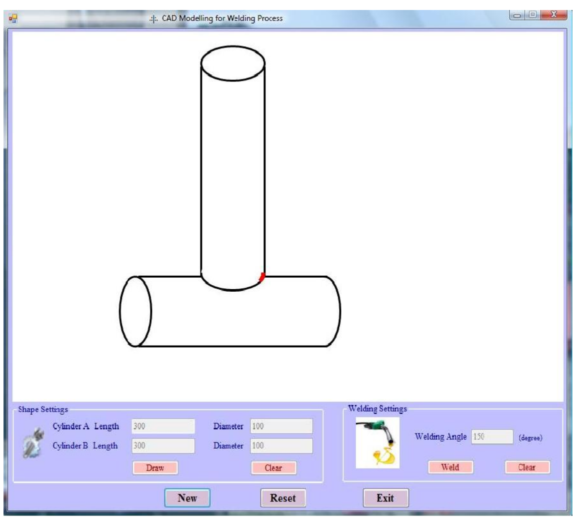
INTERFACE 3

Clicking Draw under Process in interface 2 will display this interface which has a Shape Setting at the left bottom and contains the lengths and diameters of Cylinders A and B. At the same time the Welding setting contains the welding Angle in degree.



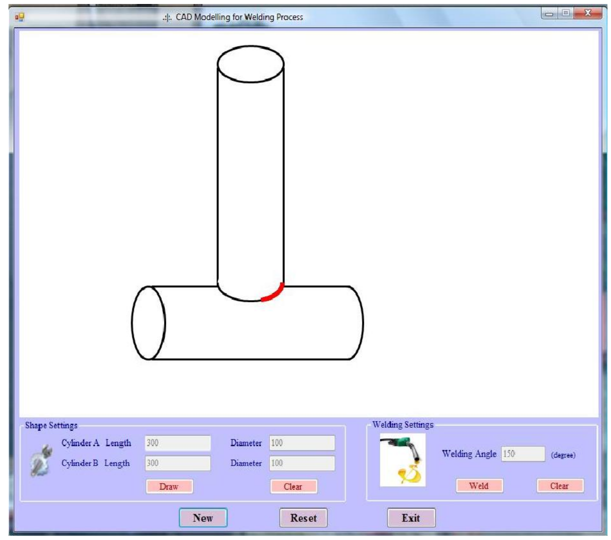
INTERFACE 4

The interface showed the cylinders to be welded. If for example we have 300mm and 100mm being computed for length diameter respectively for cylinder A, while the size of cylinder B is 300mm in length and 100mm cylinder, then clicking Draw in the shape settings automatically displayed the figure shown above and clicking Clear under the same settings will remove the diagram drawn in the interface above.



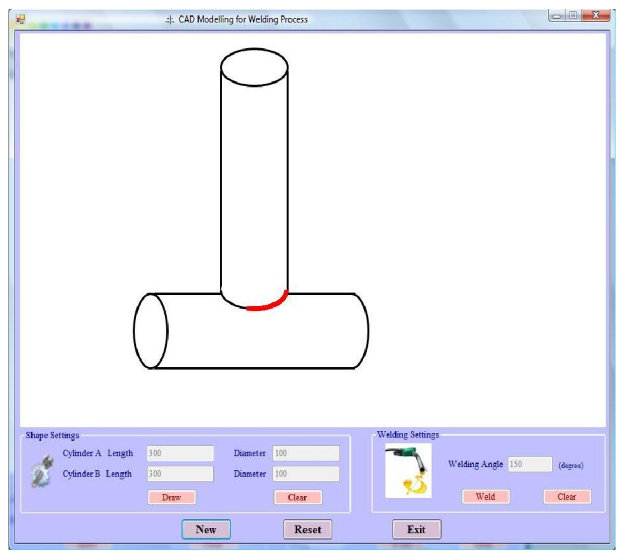
INTERFACE 5

The Welding Setting at the right bottom contains the welding angle in degrees. For example 150 degree is to be welded and clicking Weld under the Welding Settings and automatically, the welding operation commenced starting from zero position.



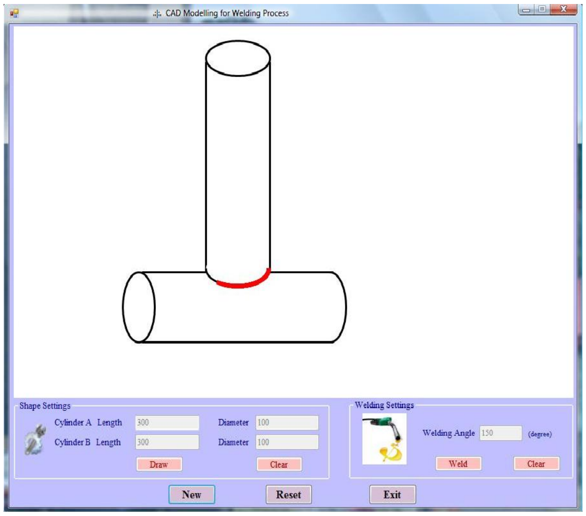
INTERFACE 6

Welding operation continues.The red line shown depicts welding seam.



INTERFACE 7

Welding operation still in progress.



INTERFACE 8

Welding operation completed. It stopped at the input figure which was 150 degrees.

Result and Discussion.

COMPARING ROBOTIC WELDING AND MANUAL WELDING

The error always encountered in robotic welding is always minimal compared to that of the manual welding.

A robotic welding system may perform more operation repeatedly than a manual welder because of the monotony of the task.

Another consideration with manual welding of large components is the arduous nature of the work. There is a risk of neck injury if the head is held for too long in one position and additionally, continuous feeding of wire into a joint can cause repetition strain injury. Such health and safety issues are eliminated if a robot is used. On the other hand, manual welding is cost effective compare to the robotic welding. Cost of maintenance of robots is so exorbitant to the extent that ordinary person can't afford it.

Cost of setting up a robot for welding operation might be unbearable for an individual.

Conclusion and Recommendation

Many factors must be considered before deciding what welding technique can benefit your shop or production process the most. Cost is a significant factor if one needs to add welding processes to a production line. Type of materials to be joined, skill of workers, automation of processes and type of products being made must all be considered. Hiring a welding consultant, welding engineer or automation design integrator will help you determine your needs in such complex situations.

The result clearly shows that Robotic welding systems are able to operate continuously, provided appropriate maintenance procedures are adhered to. Continuous production line interruptions can be minimized with proper robotic system design.

It is highly suggested and recommended that whoever that wants to take up this research work should take into consideration welding of materials in an obstructive positions.

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