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EFFECT OF DOWN TIME RATE IN FRICTION STIR WELDING OF BUTT JOINT USING EMBEDDED C PROGRAMME

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Abstract

Friction stir welding is solid state joining process where the energy efficiency is dependent on the selection of tool geometry. The aim of this paper is to investigate the effect of down time rate in friction stir welding using embedded C program. The friction stir welded plate strength is dependent mainly by controlling the major weld parameters. The major weld parameters are axial load, rotational speed and transverse speed. The effect of downtime can be considered as one of the additional welding parameter and generated by coding using embedded C program. Changes in heat dissipation for different plunge down time is measured experimentally and compared with ANSYS output.

Key Words:

Heat dissipation, friction stir welding, PLC program, down time rate.

Introduction

Frictional stir welding is process joining similar and dissimilar metals using non consumable tools. The main parameters involved in calculating the energy and temperature models of taper tool are rotational speed, transverse speed in rpm and axial load in kN. The source for joining the two metals is formation of heat which may be from the chemical or electrical energy during the process.

The parent alloy used was AA 6061 – T6 Aluminium plates and AZ61 plates with thickness of 6mm, the chemical compositions are given in Table 1.

(a) (b)

Fig.1 Friction Stir Welding of Similar alloys: (a) AA6061-AA6061 (b) AZ61-AZ61.

Fig.2 Friction Stir Welding Tool.

Table-1: Chemical compositions.

Alloy	Al	Si	Fe	Cu	Mn	Mg	Cr	Ti	Zn
AA 6061	Bal	0.66	0.30	0.27	0.03	1.00	0.18	0.02	0.05
AZ61	6.2	0.1	0.005	0.05	0.15	92.29	-	0.6	0.6

Table-2: Welding parameters.

Parameter	Value
Rotation speed (rpm)	900
Welding speed (mm/min)	40
Tool shoulder diameter (mm)	18
Pin diameter (mm)	6
Pin length (mm)	5.8
Pin profile	Bobbin head

A non consumable welding tool made of M2 steel was applied to fabricate the joints.

The high amount of alloying elements added to increase the strength due to the formation of large intermetallic precipitates during casting the thermo mechanical processing are too large.

The concept stated by FSP are the same as those of friction stir welding (FSW) [1]. The utility of FSP was recently utilized with several alloy systems. A fine grained microstructure produced alloys capable of high strain-rate superplasticity, 5mm 7075 Al [2]. This manuscript reports an initial investigation of FSP modification of Al fusion welds. Research to establish the optimal combination of tool parameters and tool design for fusion welded 5083-H321 is in progress. Table 1 contains the chemical composition of the 5083-H321 Al alloy as reported by the alloy manufacturer. Automated metal inert gas (MIG) welding of 6mm thick 5083-H321 Al was performed parallel to the longitudinal direction of this rolled plates. Friction Stir Processing utilized two different tools: a tool with small diameter shoulder and a customized pin and a tool with a larger diameter of customized pin with a shorter length. Currently the exact design and operating parameters of the tool are appropriate. The larger diameter scrolled shoulder tool was designed for FSP of the entire fusion weld crown, while the small diameter shoulder tool was designed for FSP of the fusion weld toes. Friction Stir Processing was performed with the tool operating in Z- axis load control. In this study, four Friction Stir Processing conditions are examined as fusion welded, tool with small shoulder that is fusion welded on the advancing side of the FSP tool, tool with small shoulder with the fusion weld on the retreating side, and large shoulder tool.

C Programme

```
#include <16F877A.h>              // PIC IC 16F877A Header File
#fuses HS,NOWDT,NOPROTECT,NOLVP    // No use of Watchdog Timer
#use DELAY(CLOCK=16000000)        // IntClk Crystal Speed 16MHz
#use rs232(baud=9600,xmit=PIN_C6,rcv=PIN_C7)  // UART communication port declaration
#BYTE oprg = 0x81     // operation Register select
#BYTE tmr0 = 0x01     // selects Timer0
#BIT tmr0if = 0x0b.2  // Overflow Flag bit selects
#BIT GIE=0x0b.7       // Global Interrupt Enable
int SENSOR_A_VALUE=0,SENSOR_B_VALUE=0,SENSOR_C_VALUE=0,SENSOR_D_VALUE=0,COUNT;
float VELOCITY,TOUT;
```

```
void main()
{
oprg=0x07;
tmr0=0x00;   // Timer 0 was selected instead of other timers
while(1)
 {
if(input(pin_A0))   // sensor 1 triggered it will go high
      {
      COUNT=0;                    // Count value initilizes to 0
enable_interrupts(INT_TIMER0);   // Timer On
      GIE=1;              // Global Interrupt Enable
      SENSOR_A_VALUE=COUNT; // Position From sensor A
if(input(pin_A1))  // sensor 2 triggered it will go high
     {
      SENSOR_B_VALUE=COUNT;   // Position From sensor B
if(input(pin_A2)) // sensor 3 triggered it will go high
     {
      SENSOR_C_VALUE=COUNT;   // Position From sensor C
if(input(pin_A3))  // sensor 4 triggered it will go high
      {
disable_interrupts(INT_TIMER0);    // Timer shut down here
      GIE=0;          // Disable the Global Interrupt Enable
      SENSOR_D_VALUE=COUNT;// Position From sensor D
      TOUT=SENSOR_D_VALUE/61.03;
      VELOCITY=0.01/TOUT;
                /*
```

```
            Fout=(16MHz)/(4*256(256)*count)

            Fout=61.03/count

            Tout=Count/61.03

            velocity = (10mm)/Sec or (0.01m)/Sec

            */

     }   //Sensor D

    }    //Sensor C

   }     // sensor B

  }      //sensor A

 }       //while loop

}        //main loop

#INT_TIMER0         // Timer0 Interrupt

void tmr0int()

{

  COUNT++;   // When Interrupt occurs it will increase by 1

}
```

Results and Discussion

After the successful execution of the C program ,the results obtained is precise and similar to the value generated from the numerical formulation and here the decimal values being consider and the formulation shows more accuracy rather than the to the manual numerical formulations and calculations. The C program used for the taper model is being shown above generates results is shown in the below figure.2.

Conclusion

The numerical formulation of the energy and temperature equation of the taper model of various aluminium alloys has described. The model accounts for the heat generated due to the friction between tool and the work piece surfaces. The comparison between the manual numerical formulation is compared with the C program generated values resulting is close similarity, thereby concluding that C programming be efficient to generate results.

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