INDUSTRIAL ROBOTICS MINI-PROJECT

ARC WELDING OF TABLE FRAME TO SHELF

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BT18MEC044

ROBOT USED : ABB IRB 2600

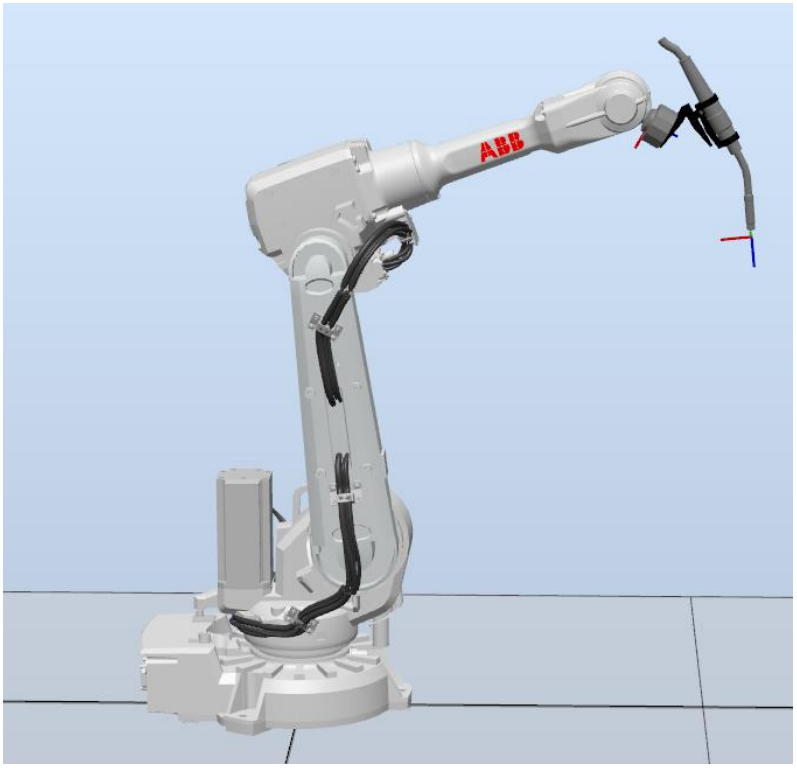


ABB IRB 2600 with Arc Welding Gun attached. It is a 4R robot.

OBJECTIVE :

Simulating the arc welding of a steel table frame to the shelf using RobotStudio.

PREFACE:

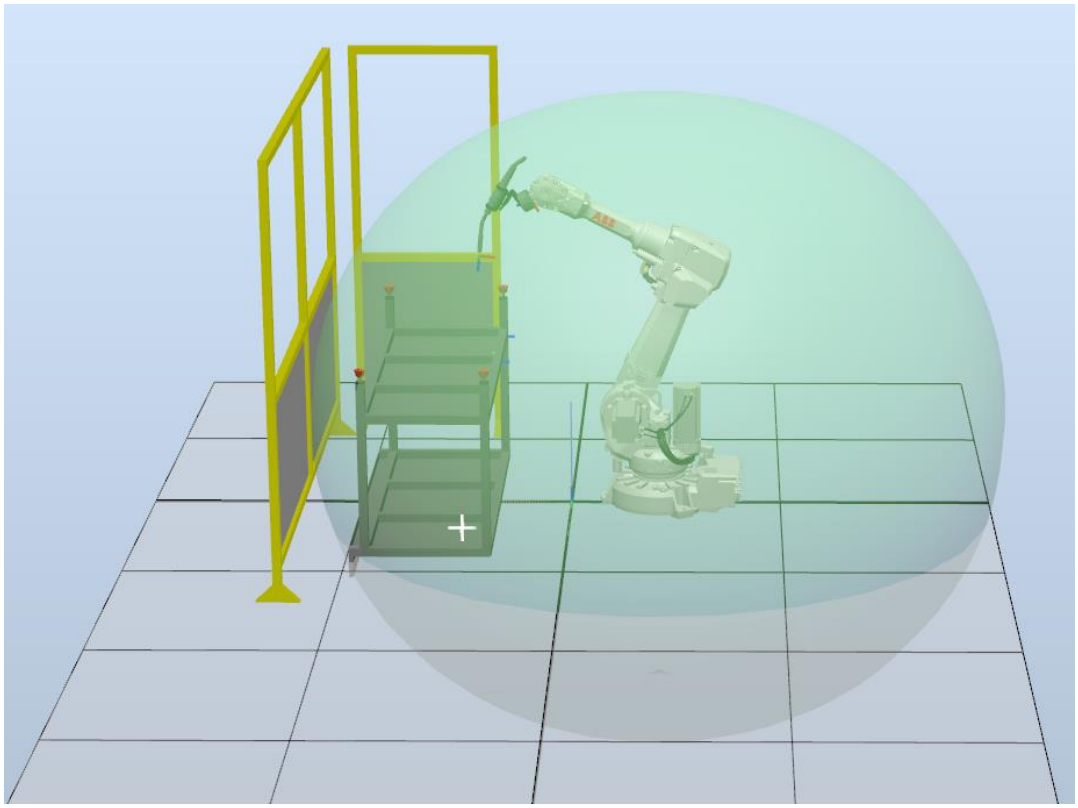
The industry shop floor is increasingly becoming automated and arc welding is no exception. The automobile industry is one example where robots are extensively used for the plethora of welds in an automobile chassis. Welding, however, is prevalent in our daily life as well, be it window railing or a bench or a table. These products are mass produced; hence it is imperative for the welding involved to be automated.

PROBLEM STATEMENT:

Arc welding the steel table frame to its shelf using a robot and simulating the same in RobotStudio. The table frame is already spotwelded to the shelf and tabletop before hand to restrict movement. The table is upturned to facilitate access of robot end effector to places difficult to access.

SELECTION OF ROBOT :

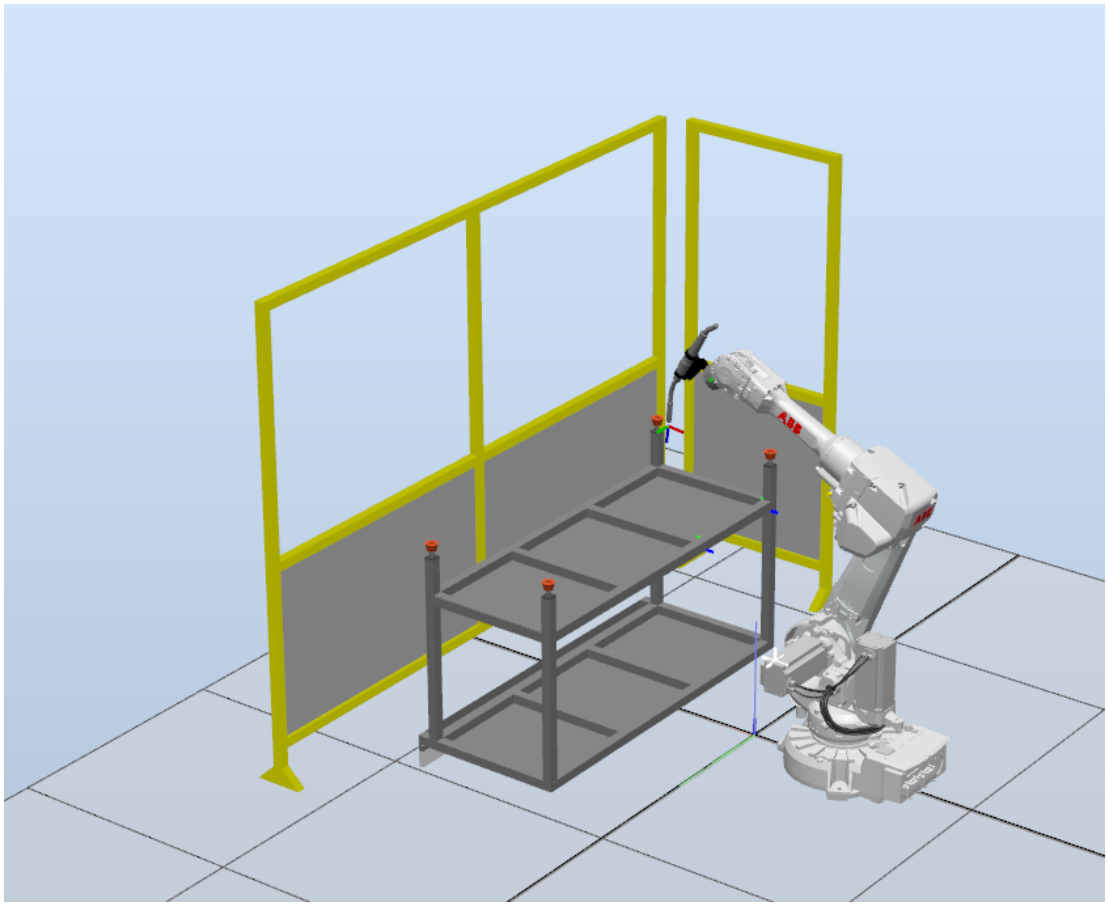
The primary requirement is that the robot’s workspace should encompass the entire steel frame. Other considerations would be cost of the robot for mass production, accuracy, and precision of any given robot for the weld, maintenance, singularity analysis, flexibility, etc. Most of these considerations are beyond the scope of the current discussion. The robot chosen is ABB IRB 2600.



3D workspace of ABB IRB 2600

WORK-CELL SET-UP :

Considering the danger, the weld fumes and light pose to human eyes, the robot operation needs to be fenced appropriately. Here, 2 fences are showed. Depending on the position of conveyor belts and other robots in the work cell responsible for moving workpieces, spot welding, replacing workpieces, etc., fences need to be appropriately placed. Currently an isolated welding operation is considered. In an industry setting, the fencing is from all sides including top and bottom, but that cannot be implemented in this simulation owing to visibility.



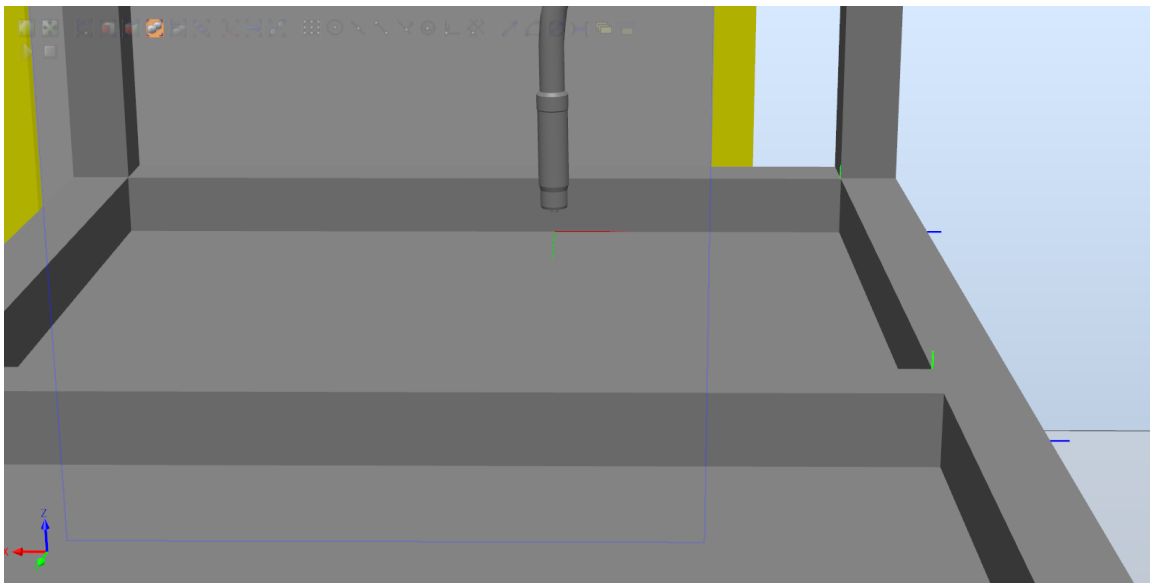
Work cell for this project

Car chassis welding production line. PHOTO COURTESY BOSCH REXROTH

WELDING PARAMETERS MOTION PLANNING :

Setting welding parameters :

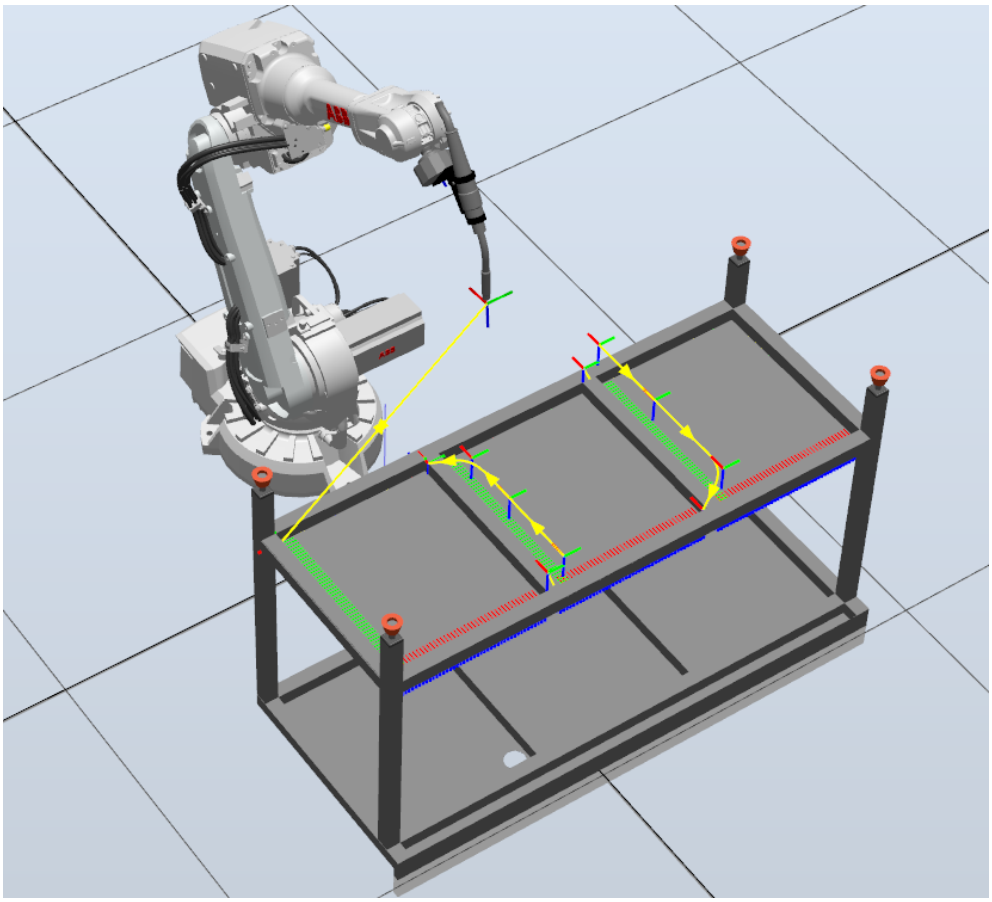
In this simulation, the arc welding gun is pointed vertically downward i.e. both the travel and work angles are 90^0. The speed is kept v50(50mm/s) for the welds and v1000 during other times. The length of arc is the default setting in the AW_Gun in RobotStudio. The goal of this simulation is to demonstrate robot arc welding operation in RobotStudio and plan its trajectory and not to delve into welding technicality. However, in actual practice, some involved consideration is needed to decide angles, speed and other parameters. For example, in travel angle is often not 90 degrees to allow the welder a better view of the puddle (in this case the robot). If, however, the robot has access to other cameras in the work cell to observe the weld puddle, it can keep the angle vertical. Arc welding length usually of the order of electrode diameter and can be set accordingly in a real application. The speed of the welding needs to be set according to thickness of material to be welded, current and voltage settings, type of welding, etc. The welding speed chosen currently is too high for most applications. It is so chosen to keep the simulation video duration from getting absurdly large.



Length of Arc

Motion Planning :

The path of the weld gun is planned to cover all the edges of the frame. Depending on strength considerations, application and optimizing resource utilization some of the edges can be skipped.



The paths taken by the weld gun for welding the frame to the shelf. The robot is in home position set for this job.

The robot returns to its home position after the weld is finished. The current simulation does not include joining of the frame to tabletop.

RESULTS:

A detailed path for the welding problem was planned and simulated. The model developed in this study is minimalistic and can be easily built upon for any application by incorporating parameters after a more involved consideration of welding as discussed previously.

Click on the following link to access the video of the simulation:

Simulation

Click on the following link for the Rapid Code generated by RobotStudio :

Rapid Code

CONCLUSION:

The current study opens many avenues for welding solutions such as mass production using a conveyor, incorporating multiple robots to reach areas with limited accessibility or to clamp the workpiece thus eliminating the need of spot welding.