

## Robot Risk Assessment and Its Control Measure

R. Srinath<sup>1</sup>, Dr N.Sivasankaran<sup>2</sup>

<sup>1</sup>PG Student, Industrial Safety Engineering, KSR College of Engineering, Tiruchengode

<sup>2</sup> Professor & Head , Department of Mechanical Engineering, KSR College of Engineering, Tiruchengode

**\*Corresponding Author**

rsrinath18@gmail.com

(R. Srinath)

Tel.: +91 8610823488

**ABSTRACT:** Designers of industrial and commercial robotic systems must consider a wide range of safety risks, for their users, the environment and the robot itself. Robotic systems therefore, as with all safety critical systems, require rigorous analysis at all parts of the design, to ensure the system is safe. As the first large consumer of robotic systems, the manufacturing industry has developed many of the robotic design methods that are used today. These methods were adapted from design principles and practices from other industrial sectors. Incorporated into the design process were proven techniques such as hazard analysis, failure analysis, rigorous design and extensive inspection and testing. In addition to these, several safety standards for robotics have been developed; most notably ISO 10218-1 [12] and ANSI /RIA R15.06 [2]. As discussed, the methods currently employed by robotic design not appropriate for designing safe robots operating in unstructured environments. This is due to the high complexity associated with a system that must adapt to changes in its environment and perform actions which cannot always be anticipated during development.

**Keywords:** Safety Standards, Robotic systems, Hazard Analysis

### 1 Introduction

Hazard analysis involves identifying and evaluating potential hazards in a system, which may cause or contribute to an unplanned or undesirable event. Hazards which are directly related to the system are known as functional hazards. Conversely, non-functional hazards relate to everything external to the system, such as the users or the environment. Several hazard analysis technique exist, many of which evaluates a system using a methodology appropriate for an industry. These methods were adapted from design principles and practices from other industrial sectors. Incorporated into the design process were proven techniques such as hazard analysis, failure analysis, rigorous design and extensive inspection and testing.

### 2.Literature Survey

J. Wolak (1977) and K. N. Murthy (1987)[1] investigated that after a threshold pressure, the MRR and penetration rate increase with arm pressure. The

maximum MRR for brittle and ductile materials are obtained at different impingement angles. For ductile material impingement angle of 15-20 results in maximum MRR and for brittle material normal to surface results maximum MRR.

Dr.A. K. Paul &P. K. Roy (1987)[4] Carried out the effect of the carrier fluid (air) pressure on the MRR, AFR, and the material removal factor (MRF) have been investigated experimentally on an indigenous AJM set-up developed in the laboratory. Conducted Experimentation on the cutting of Porcelain with Sic abrasive particles at various Air pressures. Observed that MRR has increased with increase in grain size and increase in nozzle diameter. The dependence of MRR on standoff distance reveals that MRR increases with increase in SOD at a particular pressure.

– Hazard and Operability studies (HAZOP)

– Event Tree Analysis (ETA)

– Fault Tree Analysis (FTA)

### 3. Working Operation

The first step in any hazard analysis technique, according to Bahr, is to 'understand the physical and functional characteristics of the system under study'. This involves not only looking at the way the system functions, but also the interrelationship of all subsystems and how they may impact the system. This, as Bahr states, is often a problem area for engineers, who feel they understand how a system works. Discussed previously, hazard analysis involves assessing the system requirements, with the aim of identifying potential hazards associated with system operation. Before hazard analysis can take place, the system specification must be produced. This involves first outlining the customer requirements, which lead to task analysis. These complementary processes result in a document specifying exactly what the system should do and how it will do it. From this document the functional requirements are identified. These requirements relate to the way in which tasks will be performed within the system, and the transformation from system input to system output. Once these processes are complete, hazard analysis can take place, although as with many development methodologies, requirements may be revised at any time. Our hazard analysis methodology seeks to bring the development of a safety protection system into the hazard analysis process. This we argue will allow verification that the safety schemes, identified during hazard analysis, have been implemented appropriately. This sentiment is supported by the work of Swarup and Ramaiah, who state that the most effective way to ensure a system will operate safely, is to build safety in from the start. The remainder of this paper details the design decisions involved in the development of the safety protection system and the strategy used to integrate it into the hazard analysis process.

#### 3.1 Advantages

1. High accurate finish can be obtained depending upon the Arm sizes
2. Depth of damage is low (around 2.5 microns)
3. Process is free from chatter and vibration as there is no contact between the welding tip and work piece
4. Capital cost is low and it is easy to operate and maintain.

5. Thin sections of hard brittle materials like germanium, mica, silicon, glass and ceramics can be machined.

### 3.2 Applications

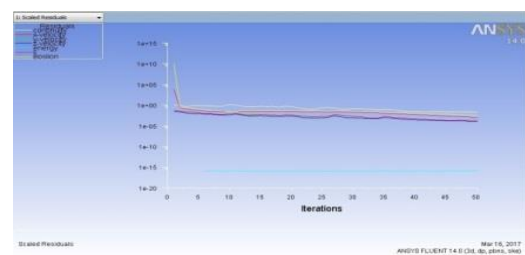
1. To remove defected particles without contact of work piece areas.
2. All Industrial robot welding applications.

### 4. Design and Analysis

#### 4.1 Modeling By Using Pro - Arm



Mesh model



Calculate iterations

#### 4.2 Modeling By Using Pro - Arm



Imported model



Pick & place of Arm

## 5. Conclusion

In this project a complete design of robotic arm Machine is given. This report details with design and fabrication of welding jet cleaning attachment for the un-conventional cleaning process. The project carried out by us made an impressive task in the works of any type of work piece (glass, metal, silicon, aluminum etc, It is very useful for the labors to make perfect welding and clean work piece dust. This project has been designed using event tree and fault tree analysis using 14.0 to perform the entire requirement task, which has also been provided.

## References

1) B.O. Omijeh May- 2007” Design Analysis of a Remote Controlled “Pick and Place” Robotic Vehicle

“(International Journal of Engineering Research and Development. Volume 10, PP.57-68) China.

2) Vipul J. Gohil March - April 2007” Robotics Arm Control Using Haptic Technology” (International Journal of Latest Research in Science and Technology ISSN (Online):2278-5299 Volume 2, Issue 2: Page No.98-102). China.

3) Prof. A. Reshamwala, R. Singh April 2013 “A Review on Robot Arm Using Haptic Technology” (International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 4, Issue 4,) India.

4) Goldy Katal, Saahil Gupt Aug-2013“Design and Operation of Synchronized Robotic Arm “(International Journal of Research in Engineering and Technology Volume: 02 Issue: 0) Poland.

5) Shyam R. Nair May 2014 “Design of a Robotic Arm for Picking and Placing an Object Controlled Using Lab VIEW” (International Journal of Scientific and Research Publications, Volume 2, Issue 5) India.

6) A. Rama Krishna May-Jun 2014 “Design and Implementation of a Robotic Arm Based On Haptic Technology” (International Journal of Engineering Research and Applications Vol. 2, Issue3) China.

7) Mohamoud A. Husse JULY 2014 “Haptic Control Development of Robotic Arm” (International Journal of Control, Automation And Systems Vol.3) China. 32 .

8) Puran Singh April 2015“Design of a Robotic Arm with Gripper & End Effect or for Spot Welding” (Universal Journal of Mechanical Engineering VOL 3: 92-97) India.

9) Ashly Baby, Chinnu Augustine Apr-2016 “Pick and Place Robotic Arm Implementation Using Arduino” Volume 12, Issue 2) China.

10) Anusha Ronanki, M. Kranthi May- 2016 “Design and Fabrication of Pick and Place Robot to be used in Library” VOL-4 Issue 6. China.

11) Rahul Gautam, Ankush Gedam, Ashish Zade, Ajay Mahawadiwar, Jul -2016 “Review on Development of Industrial Robotic Arm” Volume: 04 Issue: 03. India