

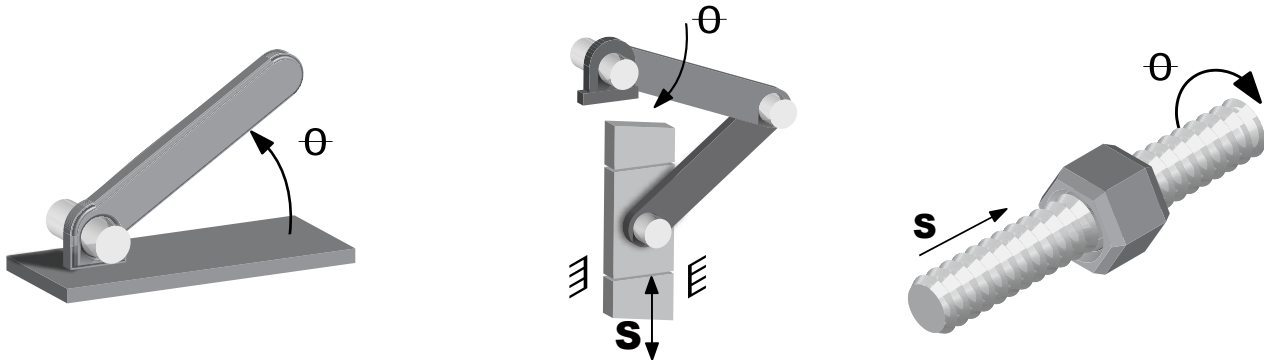


Concepts in Machine Guarding and Safeguarding

Andrew H. Tudor, P.E.

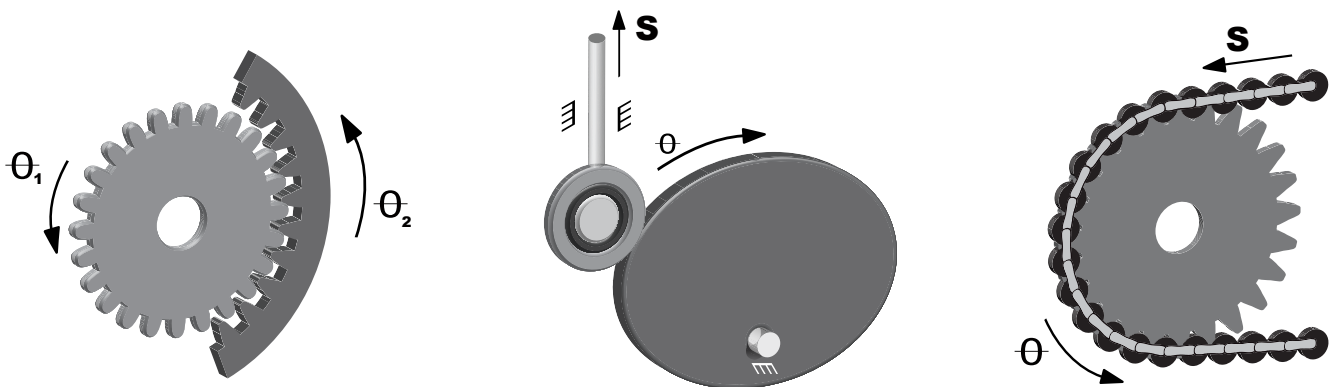
*Editors Note: This is an excerpt of a published paper that originally appeared in the **2000 International Mechanical Engineering Congress and Exposition: Safety Engineering and Risk Analysis - Safety Through Design**.*

This paper explores general concepts of machine guarding with emphasis on practical examples. Power transmission motions and their associated hazards are discussed, as is the safeguarding of hazards during machine operation and servicing.



A survey of some common safeguarding devices is presented, with explanations of their application in various situations. Guarding methods for robotic equipment are reviewed. Finally, a risk assessment model is presented with an example of its application in ameliorating the hazards of industrial robots.

The mechanical power press is used as an example of a hazardous machine for which various methods of guarding have been developed. This paper examines current safeguards and safeguarding requirements for the power press, and then presents a risk assessment method using the current robot standard.





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Risk Assessment Model (partial excerpts from paper):

The following is based on the risk assessment method used in the robot standard and illustrates the methodology used in the ANSI standard. The process for the selection of safety measures usually starts with identifying the hazards, assessing the risks and then deciding on the appropriate risk reduction method. This usually entails defining the safeguards to provide the risk reduction and specifying the safety function to be provided. The safeguards are designed in accordance with the specifications. Finally, the system is validated to verify the achieved safety function. Risk quantification is usually very difficult or impossible. This method is only concerned with the contribution to the reduction of risk made by the safety related parts of the control system. The risk assessment model is a qualitative process that gives an estimation of the risk.

Three variables relating to contact with the hazard are established:

- 1) the severity of coming in contact with the hazard,
- 2) the frequency or exposure to the hazard, and
- 3) the avoidance of the hazard by physical contact.

For more information on this paper, "Safety Through Design", and for general machine guarding regulations and recommendations, contact us at **Meridian One, Inc.**

Mechanical Robotic Arm

With conventional machinery, movement takes place within the fixed machine, whereas with industrial robots the size and shape of the danger area, i.e., the relevant working space and maximum range of movement may not be immediately recognizable. For this reason, precautions must be taken to safeguard this zone.

The oval in the diagram displays the potential range of motion that the arm, and the object being transported, can travel.

