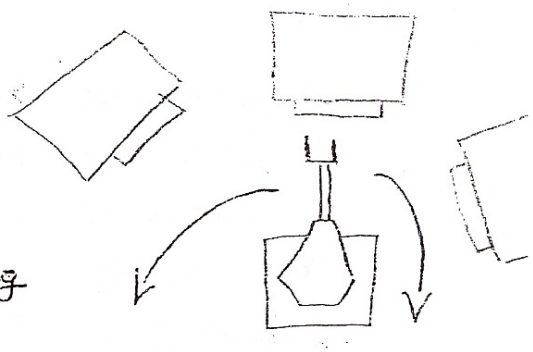
Mechatronics

Summer 2005 - Robot Workcells

22(a) Robot Centred Cell :



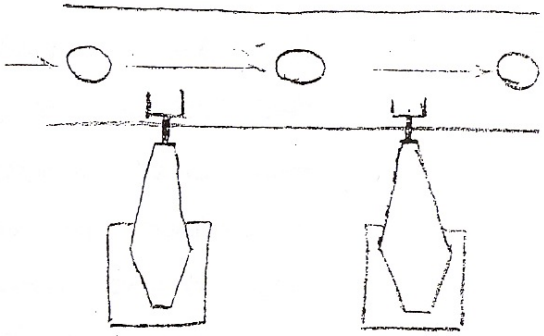
In the robot centred cell the robot is positioned at the cell centre with a number of machines surrounding it that are to be serviced by the robot. This form of cell ensures good utilisation of the robot as it is servicing multiple machines and is not idle for long. This cell orientation does, however suffer from a parts delivery problems as the parts must be supplied to the robot at a discrete location. A typical app of this form of workcell is for die casting applications.

(b) In Line Cell :

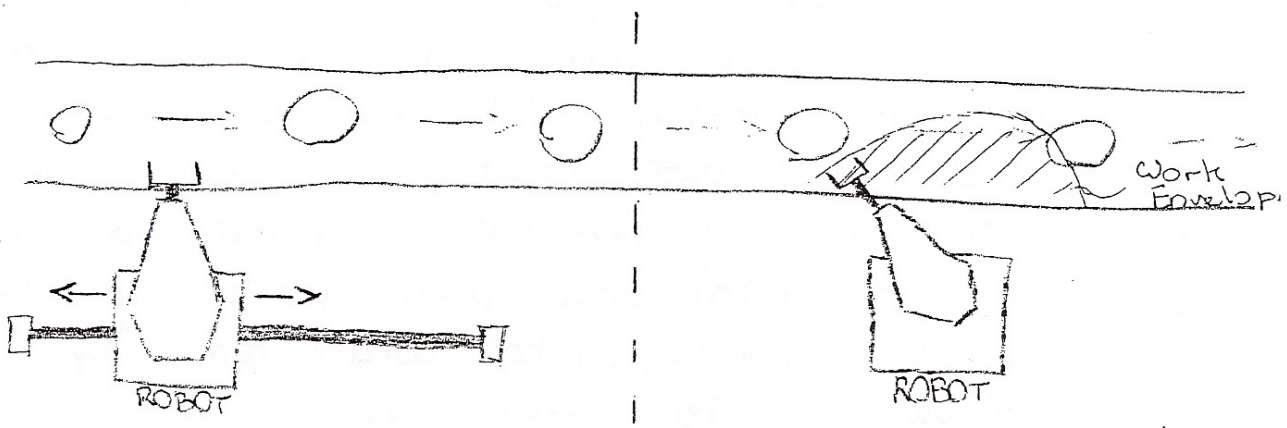
Intermittent:

For this form of In-Line workcell the conveyer stops when the part is in front of each robot. As the part is stationary this form of In-Line Cell requires the robot to register the part location which, without utilising an observer, requires accurate conveyer control and part positioning. As the part is stationary, robot control complexity is reduce relative to other In-Line Cell layouts.

* Continuous :



A continuous In-line workcell involves the part moving at a constant velocity while the robot performs its operation. This presents significant difficulty of part registering which is solved in one of two ways. * Using moving baseline tracking the robot moves with a velocity equal to the part to be worked on this however complicates the mechanical layout of the workcell. Additionally using moving baseline tracking collision avoidance must be utilised. * Using stationary baseline tracking the robot base remains stationar and uses complicated control software & hardwa to maintain the robot tool head stationary relative to the part being manipulated. This approach is highly versatile but requires collision avoidance and suffes from a limitation in the work volume as seen below:



Moving Baseline

Stationary Baseline

* Non - Synchronous:

This form of In-line workcell helps to optimis the use of resources by having each part move independantly from workcell to workcell. This of course means a more complicated and expensive conveyer system as each part requires its own transport but also conversly simpler robot control. This is typically used in the automotive indust

(C) Mobile Robot Cell:

This method of workcell involves taking the robot to the part or machine via the use of either an overhead or floor mounted rail system. Although costly to set up it allows the robot to service a number of machines and in the case of the overhead rail uses up less floor space.

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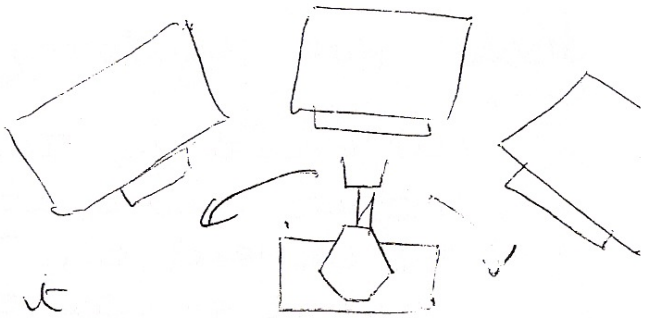
Robot centered cell



— operation :.

robot positioned at cell centre, with no. of machines surrounding it that are to be serviced by robot

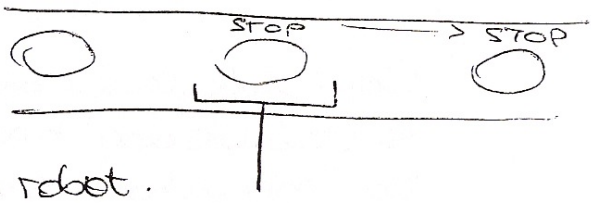
+ve ⇒ good utilisation of robot : servicing multiple machines, not idle for long.

-ve parts delivery problem as parts must be suppl to robot at a discrete location. ~~Faults~~

Particular application example : diecasting.

In line cell.

① Intermittent :

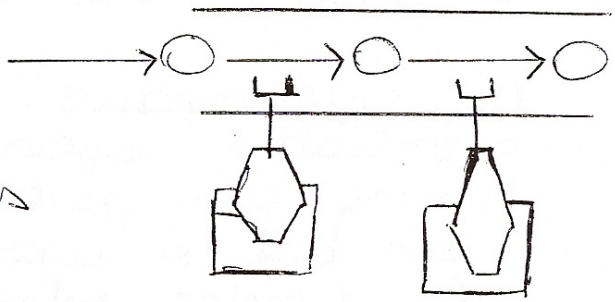


Operation:
conveyor stops when the part is in front of each robot.

adv Since part is stationary, robot control complexity is reduced relative to other inline cell

disadv Robot must register part location. Without utilising an observer, this requires accurate conveyer control and accurate part position

② Continuous



Operation :
part moving at constant velocity while robot performs its operation

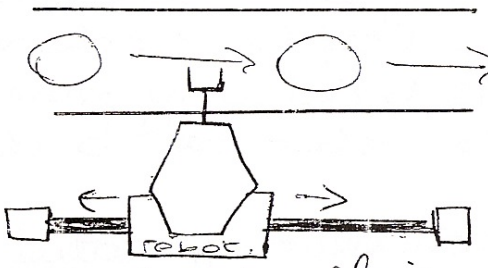
adv fast moving, continuous, versatile production line

disadv: part registering problem: 2 solutions

a) moving baseline tracking

robot moves at velocity equal to part to be worked on. This complicates mechanical layout of workcell.

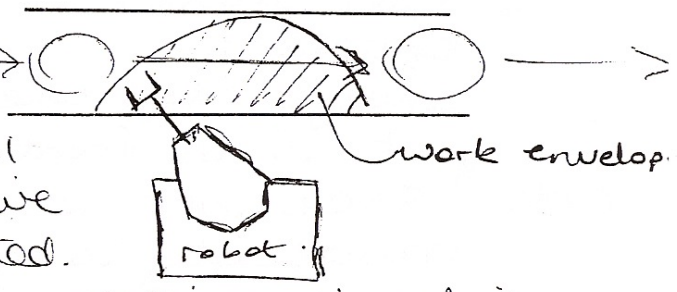
Baseline tracking collision avoidance must be utilised



moving baseline

(b) stationary baseline tracking

Complicated control software and hardware to maintain robot tool head stationary relative to part being manipulated.



stationary baseline

+ve: highly versatile

-ve: highly complicated, requires collision avoidance and suffers from a limitation in work volume which can be done.

Non synchronous.

opration: optimises use of resources by having each part move independently for work cell to workcell.

adv: simpler robot control

disadv: more complicated and expensive conveyor system as each part requires its own transport

Typical application in automotive industry.

(c) Mobile Robot Cell:

Operation

Involves taking robot to the part or machine via use of overhead or floor-mounted railsystem

adv allows robot to service a number of machines

in case of overhead rail it saves on floor space.

disadv costly to set up.