LECTURE-16

Design for Assembly

- *"a process for improving product design for easy and low-cost assembly, focusing on functionality and on assemblability concurrently."*

<div align="right">--Vincent Chan & Filippo A. Salustri</div>

Design for Assembly

- Reduce cost of assembly

- Improve quality and reliability

- Reduce part inventory

- Reduce production equipment

Assembly Methods

- Manual assembly

- Fixed automatic assembly

- Flexible automatic assembly

Design Guidelines for Manual Assembly

- eliminate the need for workers to make decisions or adjustments.

- ensure accessibility and visibility.

- eliminate the need for assembly tools and gauges (i.e. prefer self-locating parts).

Using Jigs & Fixtures

Hull Forming Jigs at Offshore Steel Boats Ltd.
Image source: www.geograph.org.uk/photo/1230702

Design Guidelines for Manual Assembly

- Minimise the number of standard *different* parts – use *'standard parts.'*

- minimise the number of parts.

- avoid or minimise part orientation during assembly (i.e. prefer symmetrical parts).

- prefer easily handled parts that do not tangle or nest within one another.

Design Guidelines for Automated Assembly

- reduce the number of different components by considering
  - does the part move relative to other parts?
  - must the part be isolated from other parts (electrical, vibration, etc.)?
  - must the part be separate to allow assembly (cover plates, etc.)?
- use self-aligning and self-locating features
- avoid screws/bolts

Design Guidelines for Automated Assembly

- use the largest and most rigid part as the assembly base and fixture.

- Assembly should be performed in a layered, bottom-up manner.

- use standard components and materials.

Design Guidelines for Automated Assembly

- avoid tangling or nesting parts.
- avoid flexible and fragile parts.
- avoid parts that require orientation.
- use parts that can be fed automatically.
- design parts with a low centre of gravity.

Basic DFA Guidelines

- Minimise part count by incorporating multiple functions into single parts

- Modularise multiple parts into single sub-assemblies

- Assemble in open space, not in confined spaces; never bury important components

- Make parts such that it is easy to identify how they should be oriented for insertion

- Prefer self-locating parts

Basic DFA Guidelines

- Standardise to reduce part variety

- Maximise part symmetry

- Eliminate tangling parts

- Colour code parts that are different but shaped similarly

- Prevent nesting of parts; prefer stacked assemblies

- Provide alignment features

Basic DFA Guidelines

- Design the mating features for easy insertion
- Insert new parts into an assembly from above
- Eliminate re-orientation of both parts and assemblies
- Eliminate fasteners

Basic DFA Guidelines

- Place fasteners away from obstructions; design in fastener access
- Deep channels should be sufficiently wide to provide access to fastening tools; eliminate channels if possible
- Provide flats for uniform fastening and fastening ease
- Ensure sufficient space between fasteners and other features for a fastening tool
- Prefer easily handled parts

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HNC year 1