

Ready configuration of a new machine into a manufacturing system

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Overview

- Aim & Background
- Experimental Studies
- Summary

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Aim

- To present tools and methods to evaluate reconfigurability of a manufacturing system.
- To propose an integration method for new machines into a conventional manufacturing system
- To present preliminary evaluation results

Background – reconfigurability definition

- Reconfigurability : The ability to add, remove and/or rearrange in a timely and cost-effective manner the components and functions of a system which can result in a desired set of alternate configurations

Background – Manufacturing Reconfigurability

- Why is it desired?
 - » Short product life cycle
 - » Mass customization
 - » etc.

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Background – Distributed Manufacturing

- Problem
 - » Distributed Manufacturing Systems (DMS)
reportedly enhance reconfigurability but have not
been widely used

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Background - Reconfigurability Evaluation tools

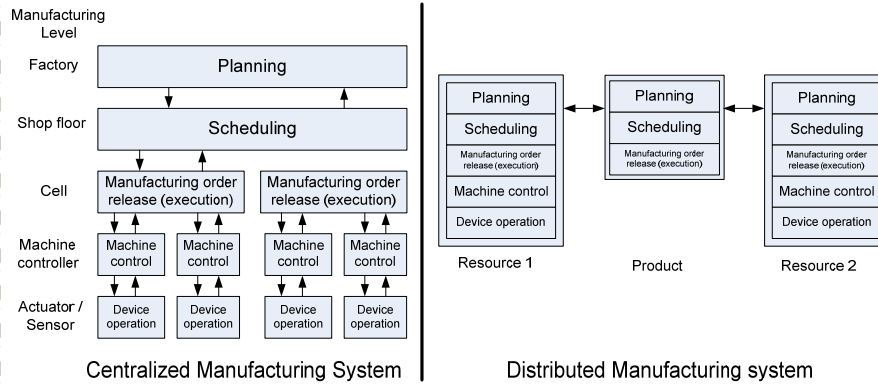
- Production Degree of Freedom (DOF)
- Complexity (C) and Extension Rate (ER)
 - » Strategic Complexity (SC), Cyclomatic Complexity (CC)
- Design Structure Matrix (DSM) (will use in future work)

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Integration approach: Intelligent “Wrapper”

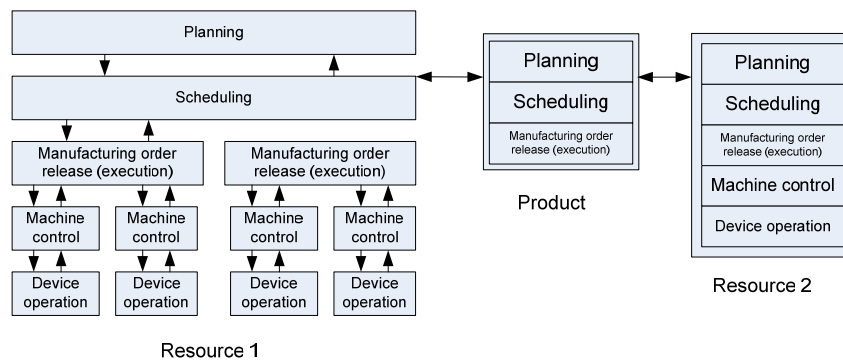
- Concept : from functional point of view a machine in a DMS is equivalent to a miniaturized factory



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Integration approach: Intelligent “Wrapper”

- Factory treated as intelligent resource

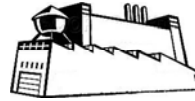


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Integration approach: Intelligent “Wrapper”



New machine



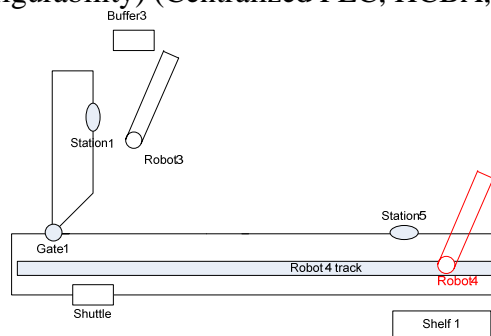
An existing manufacturing system

Experimental studies - Aim

- Evaluate and compare the reconfigurability between
 - » Centralized PLC Architecture
 - » Holonic Component Based Architecture (HCBA)
 - » The proposed “wrapper” method

Experimental studies - Approach

1. Create an existing manufacturing system (Centralized PLC, HCBA)
2. Add a new machine
3. Evaluate the effort required to add a new machine (reconfigurability) (Centralized PLC, HCBA, Wrapper)



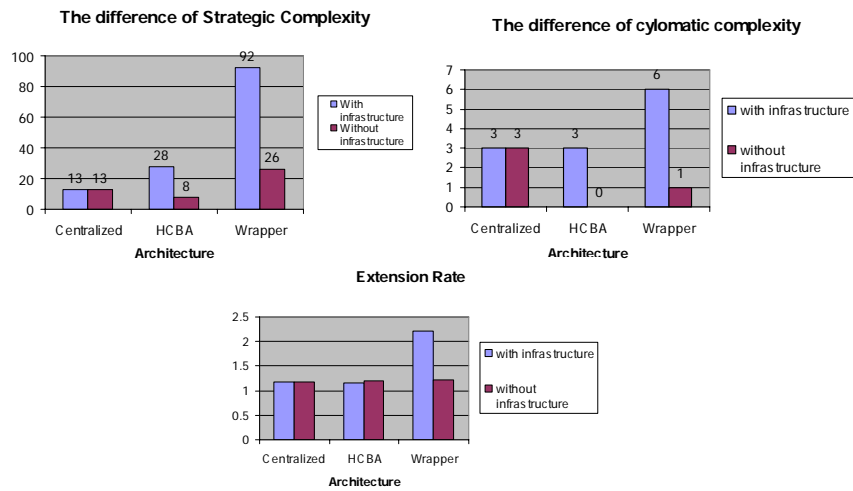
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Experimental studies - Testbed



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Experimental studies - Results



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Summary

- The migration method is presented
- The experimental studies and the results are presented
- HCBA requires less effort since most of the functions are provided beforehand. They only need to be customized.
- Wrapper method requires more effort than HCBA. This should only be the case where the wrapper is created in the first time.