

Self-Organisation in Evolvable Assembly Systems



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Project Details

PhD project
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Keywords

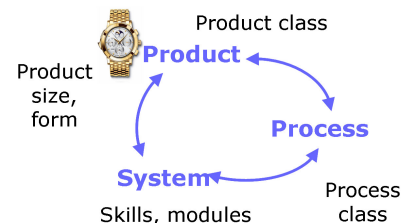
Self-Organisation
Emergence
Complexity
Industrial Robotics
Manufacturing Systems

Agile Manufacturing - Challenges of tomorrow's industry

Target cases: low production volumes, small lot sizes, many variants, frequent modifications;
Needs: high responsiveness, reconfigurable and user-friendly systems without reprogramming

Evolvable Assembly Systems

Systems evolve together with product and environment;
Process-based modularisation with MAS control solution for seamless addition, removal and exchange of modules;
Agentified modules of fine granularity with tiny computing devices for local intelligence



Self-Organisation

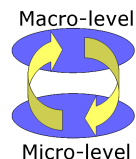
The mechanism or process enabling a system to change its organisation without explicit external command during its execution time;

Allows more system autonomy



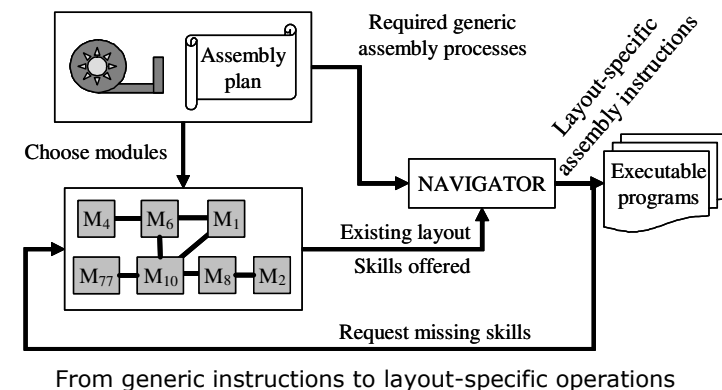
Emergence

"The whole is more than the sum of its parts" → the system can have more capabilities than those originally engineered



CoBASA (Coalition-Based Architecture for Shopfloor Agility) with dynamic coalitions for more autonomy

Embodied Intelligence: manufacturing modules are agentified and carry thorough self-knowledge. They offer simple skills and dynamically form coalitions with others to offer complex skills. 1) Agents bring assembly orders including detailed assembly plans in generic form. 2) The agents self-organise (Navigator) to transform their generic assembly processes into layout-specific assembly instructions. The agents thus find their way through the current layout to build the finished product. 3) If necessary the system re-organises itself to cope with changes and failures during production.



Key publications

R. Frei, J. Barata, and G. Di Marzo Serugendo, "A Complexity Theory Approach to Evolvable Production Systems," in Proc. of the Int. Workshop on Multi-Agent Robotic Systems MARS 2007, Angers, France, 2007.