

Self-Organisation in Evolvable Assembly Systems



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Project Details

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Keywords

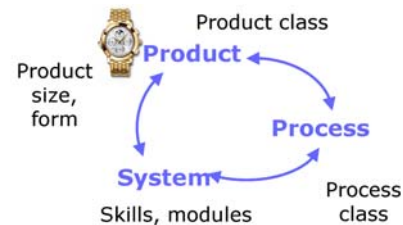
Self-Organisation
Emergence
Complexity
Industrial Robotics
Manufacturing Systems

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



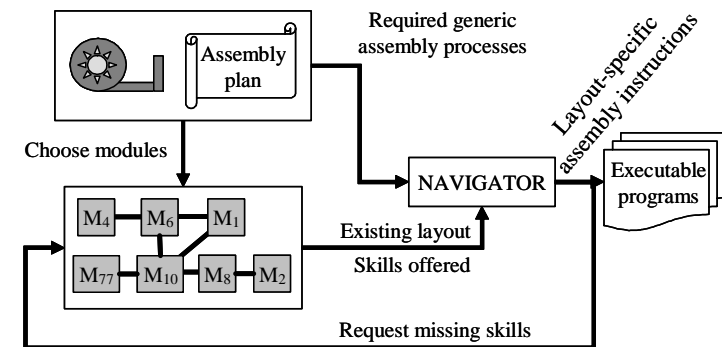
Emergence

"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.



From generic instructions to layout-specific operations

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.