Evolvable Assembly Systems

Towards Open, Adaptable, and Context-Aware Equipment and Systems
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UNITED KINGDOM · CHINA · MALAYSIA

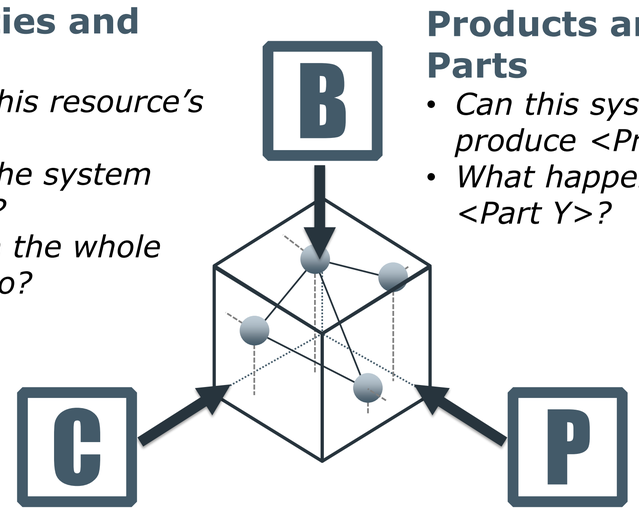
Context

Modern manufacturing companies are under economic pressure to respond more rapidly to a changing production environment, including short product life cycles, individually customisable products, and the introduction of new disruptive manufacturing processes.

A new manufacturing philosophy and software architecture is required: Evolvable Assembly Systems, based on the principles of decentralisation, context-awareness and intelligent resources, and is implemented using embedded computers, intelligent agent technology, and data distribution services.

Behaviour
- *How will this system react to a disruptive event?*
- *How do we guide the behaviour of the system to achieve our desired goals?*

Capabilities and Context
- *What is this resource's context?*
- *What is the system topology?*
- *What can the whole system do?*

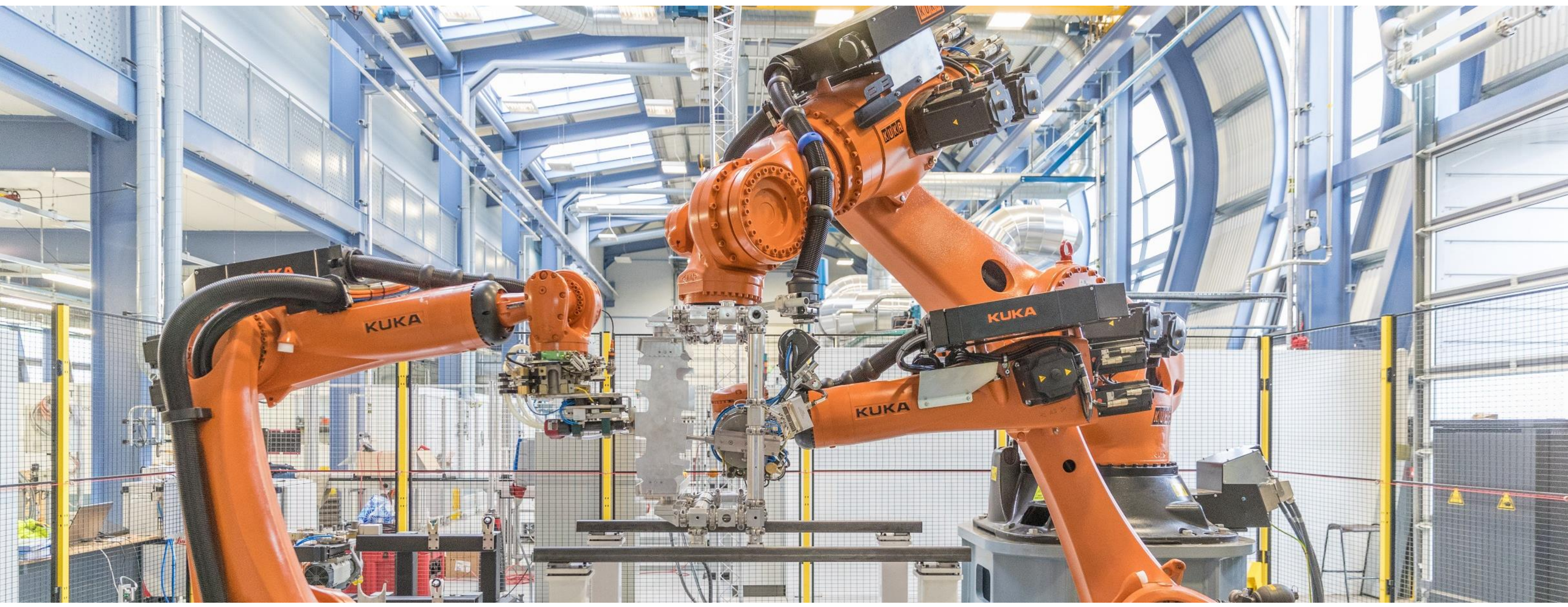


Products and Parts
- *Can this system produce <Product X>?*
- *What happened to <Part Y>?*

Integrated Behaviour Model

A shared system model allows us to view the assembly system from a number of viewpoints, or facets. Each resource in the system keeps a view of the model that is relevant to them, and decisions are made based on the state of the model.

When a disruption to the system occurs, this is reflected in the behaviour model facet. The system then automatically predicts the change to the system behaviour that will result from the disruption.



Embedded Intelligence

The Evolvable Assembly Systems approach uses embedded computers that imbues all manufacturing resources with:

- Embedded processing power and data storage.
- Wireless communication to share data with all other resources in a manufacturing cell.
- The ability to make collective decisions based on the real-time changing status of the manufacturing process.
- The ability to process products on a batch-size-of-one basis.

With this approach, even legacy equipment with outdated or no computational capability can be inducted into the Evolvable Assembly Systems architecture.

Computing power and data storage are now cheap, compact, and ubiquitous.

Smart devices help integrate human workers closer into the connected manufacturing world.

FA3D

Shown above, the Future Advanced Aerospace Assembly Demonstrator will show how EAS is applied to full-size, industrial scenarios. Highly-flexible 'plug and produce' resources with changeable end effectors, and variability-aware and flexible fixturing, combined with the computational intelligence to coordinate the resources allows a single cell to transform itself and execute the capabilities of multiple less-flexible cells.

Use of a single, highly flexible cell as opposed to multiple dedicated cells reduces equipment costs, non-recurring costs such as fixturing, and saves on both active floor space and storage space. This allows for high-complexity, low-volume products to be manufactured cost-effectively, increasing competitiveness.

Investigators, Researchers, and Partners

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