

Holonc Assembly System (Prof. T. ARAI and Dr. Y. MAEDA)

In recent years, manufacturing systems must have high flexibility (fault-tolerance, versatility, agility, etc.) to cope with dynamic changes of their environment. We have proposed a flexible assembly system with the concept of holon, as a decentralized autonomous manufacturing system.

Holons are autonomous and cooperative components of the system. They form a “holarchy” (hierarchical control architecture) to execute assembly tasks. The holarchy of the system consists of management holons and execution holons (Fig. 1). If a management holon is ordered to assemble a product, this assembly task is decomposed into subtasks for lower management holons. A management holon (operation holon) secures appropriate execution holons, which correspond to real manufacturing devices, using the contract net protocol. Then the operation holon makes the execution holons execute a simple job, such as assembling parts. We implemented a real holonic assembly cell shown in Fig. 2. The decentralized nature of the system enables us to realize “Plug & Produce,” a system function that supports easy addition/removal of manufacturing devices. We are developing some techniques for Plug & Produce, such as a distributed resource allocation method for installation of new robots (Fig. 3), and an automated calibration for mutual positional relationship between an existing robot and a newly added one (Fig. 4).

Keywords: Holon, Holarchy, Assembly, Manufacturing Systems, Plug & Produce

References

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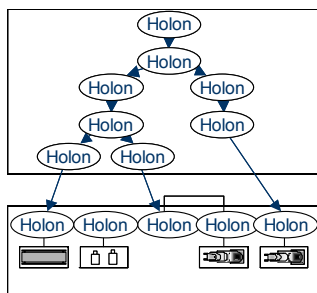


Fig. 1 Holarchy for Holonic Assembly Cell



Fig. 2 Holonic Assembly Cell

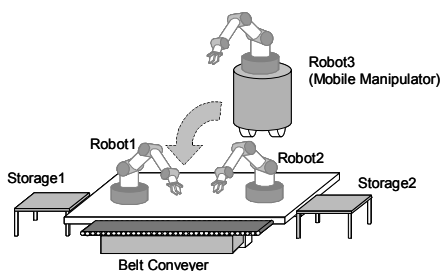


Fig. 3 Plug-in of a New Device

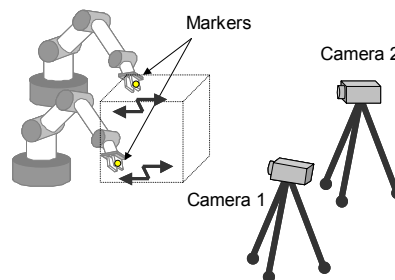


Fig. 4 Automated Calibration for Plug & Produce