

Advancing and Integrating the Performance of Robotic Systems for the 21st Century Manufacturing

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There has been increasing in developing environmentally-benign manufacturing technologies, robots, etc. This is considered a significant step in achieving sustainable development. Sustainability of a manufacturing system becomes critical technology that enables manufacturing companies to reduce production costs and improve their global competitiveness. System sustainability can be achieved by reconfiguration and decentralization, whose system configurations are evolved with the changes of design requirements and dynamic environment. The modular construction of parallel robotic machines allows them to be used as a class of reconfigurable machine tools. Nevertheless, parallel robotic machines as contemporary manufacturing robotic systems often have difficulty meeting the highly increased workplace demands on (1) operational accuracy, (2) operational load capacity, (3) task adaptability, and (4) reliability. For example, according to some large robot/robotic machine tool manufacturers and manufacturing robot user, i.e., ABB Robotics, Ingersoll Machine Tools Inc. and ATS Automation Tooling Systems Inc., the current robotic systems for high speed machining often fail due to thermal effects, which fatally distort the accuracy of the systems. According to the International Federation of Robotics (IFR), more than 60% of industry robots operating in the manufacturing industry are articulated robots (i.e., serial robots), or robots that can only allow material handling, but not material fabrication.

In this talk, the rationale of using parallel robotic machines for green and sustainable manufacturing is discussed and explained. A comparative study is carried out on some successful parallel robotic machines and conventional machine tools. Meanwhile, the latest research activities of parallel manipulators in the Laboratory of Robotics and Automation of UOIT are introduced, they are: parallel robotic machines, reconfigurable/green robotic manipulators, web-based remote manipulation as well as the applications of parallel manipulators in micro-motion device, MEMS (parallel robot based sensors), wearable power assist hip exoskeleton, and rescue robot.