Design of a force-controlled end-effector with low-inertia effect for robotic polishing using macro-mini robot approach

Abd El Khalick Mohammad a, b, *, Jie Hong a, Danwei Wang a, *

Abstract:

In this paper, the novel design of a force-controlled end-effector for automated polishing processes is presented. The proposed end-effector is to be integrated into a macro-mini robot polishing cell. The macro robot (in this study, it is a six-axis industrial robot) is used to position the mini robot (the proposed end-effector) according to the workpiece profile while the mini robot controls the polishing force. The end-effector has a polishing head that can be extended and retracted by a linear hollow voice coil actuator to provide tool compliance. The main advantage of the proposed design is that it allows this motion without extending or retracting the polishing motor nor spindle, which reduces the inertial effects that may result in undesired vibrations. By integrating a force sensor, the polishing force is measured and fed back to the controller to regulate it according to the polishing pre-planned requirements. The effectiveness of the proposed device to track a certain desired force with step changes under different feed rates has been examined through polishing experiments. The results demonstrate the effectiveness of the presented device to reduce the vibration and achieve remarkable force tracking.

Keywords:

Force-control Low-inertia Robotic polishing and macro-mini robot

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