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Abstract for ASPEN2022(500 words) Development of a PC-based open-source control system for a hybrid polishing mechanism

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Abstract. Nowadays, with the wide utilization of high precision complex freeform surface components, many advanced computer-controlled polishing processes have been developed. To implement these sophisticated polishing processes, a highly flexible computer numerical control system is necessary. However, most of the current commercial controllers are integrated. Researchers have no authority to access the underlying level to substitute or modify the existing algorithms by their developed control strategies. For instance, a purchased machine tool can only follow the pre-generated G-code file instead of modifying the tool path in real-time response to the circumstance of the manufacturing. In this paper, a PC-based open-source control system for precision polishing is presented, which can apply the customized control strategies in the position-loop. Meanwhile, based on the designed polishing mechanism, a parameterization kinematic model is optimized through the geometry method. Also, an advanced robust control strategy is applied for the position-loop of the polishing trajectory control. To enhance the usability of the proposed control system, a polishing tool path auto-generator is developed to generate the polishing trajectory, velocity, and the total cost time of the whole procedure automatically. After that, the performance of the proposed control system and related modelling works are demonstrated by simulations.