Key Technologies and Applications of Disc Cutter Changing Robot of tunnel boring machine

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ABSTRACT

To address the inefficiency, high risk, and elevated costs associated with manual disc cutter changing in tunnel boring machine (TBM) construction, this study proposes a robotic disc cutter changing system to replace human-operated processes. The system employs a three-layer architecture to enable remote operation, such as remote monitoring, motion control, and motion execution. Kinematic modeling based on the D-H parameter method is used to calculate the robot's pose, while the RRT algorithm facilitates automated path planning. Joint trajectories are generated using a fifth-degree polynomial for smooth motion. A simulation platform validates the effectiveness of these algorithms. Furthermore, parameter calibration enhances the accuracy of the robot's mathematical model, and laboratory experiments alongside engineering tests confirm the feasibility of the proposed robotic cutter-changing solution.

REFERENCES