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(54) Title: ROBOT JOINT SPACE GRAPH PATH PLANNING AND MOVE EXECUTION

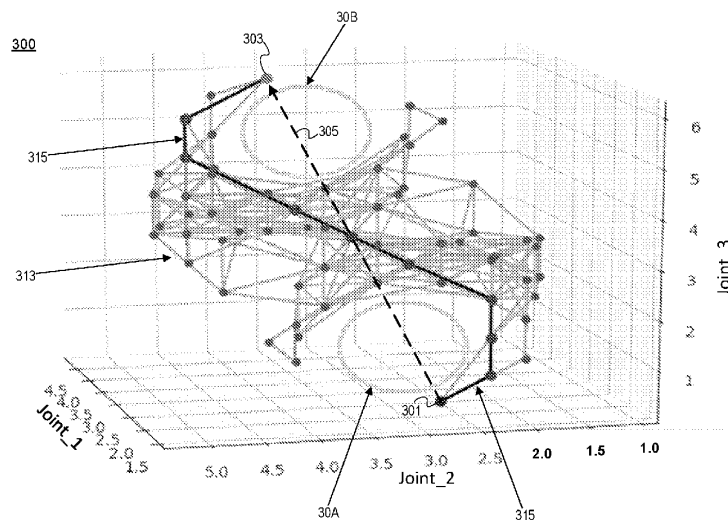


FIG. 3

(57) Abstract: A system includes a robot arm with multiple joints and one or more end effector to carry a substrate. A processing device determines, within joint space of the robot arm, start/end points of the one or more end effector for a complete movement. The processing device builds, in joint space for the multiple joints and the one or more end effector, a graph of reachable positions and subpaths between the reachable positions that satisfy Cartesian limits. The reachable positions are identified at a granularity that divides the complete movement into multiple sub-movements. The processing device executes a graph optimization algorithm on the graph to determine multiple paths, each a group of the subpaths, that have one of shortest distances or lowest costs between the start/end points, and selects a path thereof that minimizes move time of the one or more end effector between the start/end points.

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