

CONTROLLING AND/OR REGULATING MOTORS OF A ROBOT

ABSTRACT

The invention relates to a method and device for controlling and regulating motors MOT_m of a robot, with $m = 1, 2, \dots, M$, wherein the robot has robot components that are interconnected via a number N of articulated connections GEL_n , the joint angles of the articulated connections GEL_n can be adjusted by means of associated motors MOT_m ; $Z(t_k)$ is a state of the robot components in an interval t_k ; and a first system of coupled motion equations BGG is predetermined and describes rigid-body dynamics or flexible-body dynamics of the connected robot components. In the first system of motion equations BGG , $u_m(t_k)$ is a manipulated variable for the respective motor MOT_m . For the first system of coupled motion equations BGG , restrictions of the manipulated variables $u_m(t_k)$ and restrictions of the states $Z(t_k)$ of the connected robot components are predetermined. The method comprises the following steps: for the first system of coupled motion equations BGG , providing (101) a second system of locally equivalent decoupled motion equations BGE that describes the rigid-body dynamics or the flexible-body dynamics of the connected robot components; providing (102) restrictions of the manipulated variables $u_m(t_k)$ transformed into the second system and providing restrictions of the states $Z(t_k)$ transformed into the second system; providing (103) the state $Z(t_k)$ transformed into the second system as $Z^*(t_k)$; for the second system of decoupled motion equations BGE , setting (104) a target state SZ^* of the robot manipulator which is to be reached starting from the state $Z^*(t_k)$, and setting (104) one or more conditions BD^* and/or one or more characteristics KZ^* that define how to achieve the target state SZ^* ; in the second system of decoupled motion equations BGE , predicting (105) a state trajectory $ZT^*(t)$ and the associated manipulated variable trajectories $uT^*_m(t)$ depending on the state $Z^*(t_k)$ and the target state SZ^* while meeting the conditions BD^* , the characteristics KZ^* , the transformed restrictions of the manipulated variables $u_m(t_k)$, and the transformed restrictions of the states $Z(t_k)$ for an interval of $t = t_k$ to $t = t_{k+W}$, wherein $\Delta t = t_{k+W} - t_k$ is a predetermined prediction interval; transforming (106) the manipulated variable trajectories $uT^*_m(t)$ and the state trajectories $ZT^*(t)$ into the first system of coupled motion equations BGG to generate manipulated variable trajectories $uT^{**}_m(t)$ and state trajectories $ZT^{**}(t)$; from

the manipulated variable trajectories $u_{T_m}^{**}(t)$, determining (107) manipulated variables $u_m(t_{k+1})$ for the interval $k+1$ and regulating the motors MOT_m by means of the manipulated variables $u_m(t_{k+1})$; from the state trajectories $ZT^{**}(t)$ and/or on the basis of sensor data of a detection system of the state $Z(t)$, determining (108) the state $Z(t_{k+1})$ for the interval $k+1$; and for $Z(t_k) = Z(t_{k+1})$, performing again the method, starting with step (103), until a predetermined break-off criterion or the target state SZ^* is reached.

Fig. 1