

$$\begin{array}{l} t_{init}\\ t_{final}\\ \mathcal{R}\\ B\\ \dot{q}(t)=f(q(t),u(t)) \end{array}$$

$$\begin{array}{l} q\\ R_b, R_b \in \\ \mathcal{R}, b \in \\ \{0, \dots, B-1\}\\ \rho_b\\ (x_b, y_b)\\ t_{b,init}\\ t_{b,final} \leq \\ t_{final}\\ \mathcal{O}\\ M\\ O_m, O_m \in \mathcal{O},\\ m \in \{0, \dots, M-1\} \end{array}$$

$$\begin{array}{l} r_{O_m}\\ (x_{O_m}, y_{O_m})\\ t_k \in \\ [t_{init}, t_{final}] \end{array}$$

$$\begin{array}{l} O_m\\ R_b\\ d_{b,sen} \end{array}$$

$$\begin{array}{l} R_b\\ \mathcal{O}_b \subset \\ \mathcal{O} \end{array}$$

$$\begin{array}{l} R_b\\ R_b\\ ??\\ R_b\\ (q_b^*(t), u_b^*(t)) \end{array}$$

$$\begin{array}{l} q_b^*(t) \in \\ R^n\\ u_b^*(t) \in \end{array}$$

$$\begin{array}{l} R_b^p\\ q_b^*(t)=f(q_b^*(t),u_b^*(t)),\forall t\in[t_{init},t_{final}].\\ (1)\\ R_b\\ R_b \end{array}$$

$$\begin{array}{l} q_b^*(t_{init})=q_{b,init},\\ (2)\\ u_b^*(t_{init})=u_{b,init}.\\ (3)\\ R_b\\ R_b \end{array}$$

$$\begin{array}{l} q_b^*(t_{final})=q_{b,goal},\\ (4)\\ u_b^*(t_{final})=u_{b,goal}.\\ (5)\\ \forall t \in \\ [t_{init},t_{final}]\\ \forall i \in \\ [1,2,\cdots,p] \end{array}$$

$$\begin{array}{l} |u_{b,i}^*(t)| \leq u_{b,i,max}.\\ (6) \end{array}$$

$$L(q(t),u(t))=\sum_{b=0}^{B-1}L_b(q_b(t),u_b(t),q_{b,goal},u_{b,goal})$$

$$\begin{array}{l} (7)\\ L_b(q_b(t),u_b(t),q_{b,goal},u_{b,goal})\\ ?\\ \mathsf{d}(R_b,O_m)|O_m \in \\ \mathcal{O}_b, R_b \in \\ \mathcal{B}\\ \mathsf{d}(R_b,O_m) \geq 0. \end{array}$$

$$\begin{array}{l} (8)\\ \mathsf{d}(R_b,O_m)\\ \sqrt{(x_b-x_{O_m})^2+(y_b-y_{O_m})^2}-\\ \rho_b^-\\ r_{O_m}^-\\ ?\\ R_b\\ ??\\ ABCD\\ 1 \end{array}$$