t_{init}
t_{final}
$\mathcal{R}$
B
$R_b, R_b \in$
$\mathcal{R}, b \in$
$\{0, \ldots, B-$
$1\}$
ρ_b
(x_b, y_b)
$\mathcal{O}$
M
$O_m, O_m \in \mathcal{O},$
$m \in \{0, \ldots, M-1\}$
r_{O_m}
(x_{O_m}, y_{O_m})
$t_k \in$
$[t_{init}, t_{final}]$
O_m
R_b
$d_{b,sen}$
R_b
$\mathcal{O}_b$
$\mathcal{O}_b \subset$
$\mathcal{O}$
R_b
??
R_b
$(q_b^*(t), u_b^*(t))$
$q_b^*(t) \in$
R^n
$u_b^*(t) \in$
R^p

$$\dot{q}_b^*(t) = f(q_b^*(t), u_b^*(t)), \forall t \in [t_{init}, t_{final}]. \quad (1)$$

R_b
R_b

$$q_b^*(t_{init}) = q_{b,init}, \quad (2)$$

$$u_b^*(t_{init}) = u_{b,init}. \quad (3)$$

R_b
R_b

$$q_b^*(t_{final}) = q_{b,goal}, \quad (4)$$

$$u_b^*(t_{final}) = u_{b,goal}. \quad (5)$$

$\forall t \in$
$[t_{init}, t_{final}]$
$\forall i \in$
$[1, 2, \cdots, p]$

$$|u_{b,i}^*(t)| \leq u_{b,i,max}. \quad (6)$$

$$L(q(t), u(t)) = \sum_{b=0}^{B-1} L_b(q_b(t), u_b(t), q_{b,goal}, u_{b,goal}) \quad (7)$$

$L_b(q_b(t), u_b(t), q_{b,goal}, u_{b,goal})$
?
$\mathrm{d}(R_b, O_m) | O_m \in$
$\mathcal{O}_b, R_b \in$
$\mathcal{B}$

$$\mathrm{d}(R_b, O_m) \geq 0. \quad (8)$$

$\mathrm{d}(R_b, O_m)$
$\sqrt{(x_b - x_{O_m})^2 + (y_b - y_{O_m})^2} -$
$\rho_b -$
$r_{O_m}.$
?
R_b
??
$ABCD$
1
$\sqrt{(x_b - x_A)^2 + (y_b - y_A)^2} -$
ρ_b
A
2
$_{DA}, (x_b, y_b)) -$
ρ_b
$_{DA}, (x_b, y_b)) =$
$\frac{|a_{s_{DA}} x_b + b_{s_{DA}} y_b + c_{s_{DA}}|}{}$