ARCAD Lab Typings

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Slides

$$\boldsymbol{x} = \begin{bmatrix} \boldsymbol{q} \\ \boldsymbol{v} \end{bmatrix}$$

$$L(\boldsymbol{z}, \boldsymbol{\gamma}, \boldsymbol{\alpha}) = \frac{1}{2}\boldsymbol{z}^\top \boldsymbol{W}\boldsymbol{z} + \boldsymbol{g}^\top \boldsymbol{z} + \boldsymbol{\alpha}(\boldsymbol{A}\boldsymbol{z} - \boldsymbol{b}) + \boldsymbol{\gamma}(\boldsymbol{M}\boldsymbol{z} - \boldsymbol{f})$$

$$\begin{aligned}
&\nabla_{\boldsymbol{z}} L = \boldsymbol{W}\boldsymbol{z} + \boldsymbol{g} + \boldsymbol{A}^\top \boldsymbol{\alpha} + \Sigma_{i \in \mathcal{A}} \gamma_i \boldsymbol{m}_i = 0 \\
&\nabla_{\boldsymbol{\gamma}} L = \boldsymbol{A}\boldsymbol{z} - \boldsymbol{b} = 0 \\
&\nabla_{\boldsymbol{\alpha}} L = \boldsymbol{M}\boldsymbol{z} - \boldsymbol{f} = 0
\end{aligned}$$

$$\boldsymbol{q} = [\boldsymbol{q}_f^\top,\ \boldsymbol{q}_j^\top]^\top$$

$$\begin{aligned}
\min_{\ddot{\boldsymbol{q}},\mathbf{f},\boldsymbol{\tau}} \quad & \|\ddot{\mathbf{x}} - \ddot{\mathbf{x}}^{\text{cmd}}\|^2 \\
\text{s.t.} \quad & A\ddot{\boldsymbol{q}} + \boldsymbol{b} + \boldsymbol{g} = S\boldsymbol{\tau} + J^\top \mathbf{f} \\
& \ddot{\mathbf{x}}^{\text{cmd}} = K_p(\mathbf{x} - \mathbf{x}^{\text{cmd}}) + K_d(\dot{\mathbf{x}} - \dot{\mathbf{x}}^{\text{cmd}}) \\
& \ddot{\mathbf{x}} = J\ddot{\boldsymbol{q}} + \dot{J}\dot{\boldsymbol{q}} \\
& |\mathbf{f}_x| \le \mu \mathbf{f}_z,\ |\mathbf{f}_y| \le \mu \mathbf{f}_z \\
& 0 \le \mathbf{f}_z \le \mathbf{c}\ \mathbf{f}_z^{\max}
\end{aligned}$$

$$\mathbf{x} = [\boldsymbol{q}_f^\top,\ \dot{\boldsymbol{q}}_f^\top]^\top$$

$$\begin{aligned}
\min_{\mathbf{x}_k,\mathbf{f}_k} \quad & \sum_{k=0}^{N} \|\mathbf{x}_{k+1} - \mathbf{x}_{k+1}^{\text{cmd}}\|_Q^2 + \|\mathbf{f}_k\|_R^2 \\
\text{s.t.} \quad & \mathbf{x}_{k+1} = \mathbf{x}_k + \dot{\mathbf{x}}_k\ \Delta t \\
& |\mathbf{f}_{k,x}| \le \mu \mathbf{f}_{k,z},\ |\mathbf{f}_{k,y}| \le \mu \mathbf{f}_{k,z} \\
& 0 \le \mathbf{f}_{k,z} \le \mathbf{c}\ \mathbf{f}_z^{\max}
\end{aligned}$$

$$\in \mathbb{R}^6$$

$$\begin{aligned}
\mathbf{x} &= \text{FK}(\boldsymbol{q}) \in \mathbb{R}^{n_{\mathbf{x}}} \\
\dot{\mathbf{x}} &= \underbrace{\frac{\partial}{\partial \boldsymbol{q}} FK(\boldsymbol{q})}_{J \in \mathbb{R}^{n_{\mathbf{x}} \times n_{\boldsymbol{q}}}}\ \dot{\boldsymbol{q}} \\
\ddot{\mathbf{x}} &= J\ddot{\boldsymbol{q}} + \dot{J}\dot{\boldsymbol{q}}
\end{aligned}$$