where
$$l: \mathbb{R}^{n_x} \times \mathbb{R}^{n_u} \times \mathbb{R}^{n_z} \to \mathbb{R}$$
, $m: \mathbb{R}^{n_x} \times \mathbb{R}^{n_z} \to \mathbb{R}$ are the Lagrange and Mayer objective terms, respectively. The function $F: \mathbb{R}^{n_x} \times \mathbb{R}^{n_x} \times \mathbb{R}^{n_u} \times \mathbb{R}^{n_z} \times \mathbb{R}^{n_p} \to \mathbb{R}^{n_x+n_z}$, represents the (potentially) fully implicit dynamics of the system, while $F_T: \mathbb{R}^{n_x} \times \mathbb{R}^{n_z} \times \mathbb{R}^{n_p} \to \mathbb{R}^{n_x+n_z}$ describes the terminal algebraic constraint. The constraints are described by the general nonlinear functions, $h: \mathbb{R}^{n_x} \times \mathbb{R}^{n_u} \times \mathbb{R}^{n_z} \times \mathbb{R}^{n_p} \to \mathbb{R}^{n_h}$ and $h_T: \mathbb{R}^{n_x} \times \mathbb{R}^{n_z} \times \mathbb{R}^{n_p} \to \mathbb{R}^{n_{h_T}}$ and the nonlinear convex functions $g: \mathbb{R}^{n_h} \to \mathbb{R}^{n_g}$ and $g_T: \mathbb{R}^{n_{h_T}} \to \mathbb{R}^{n_{g_T}}$.

• l must be in linear least-squares form $l = \frac{1}{2} ||V_x x(t) + V_u u(t) + V_z z(t)||_W^2$

 $\int_0^T l(x(\tau), u(\tau), z(\tau), p) d\tau + m(x(T), z(T), p)$

 $t \in [0, T),$

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(1)

 $\underline{c}_0 \le C_0 x(0) + D_0 u(0) + E_0 z(0) \le \bar{c}_0,$

 $F(x(t), \dot{x}(t), u(t), z(t), p) = 0,$

 $h \leq g(h(x(t), u(t), z(t), p)) \leq \bar{h},$

 $\underline{c} \le Cx(t) + Du(t) + Ez(t) \le \bar{c},$

 $h_T < q_T(h_T(x(T), z(T), p)) < \bar{h}_T,$

 $c_T \leq C_T x(T) + E_T z(T) \leq \bar{c}_T$

 $x(0) - \bar{x}_0 = 0,$

 $x_0 \leq \Pi_{x_0} x(0) \leq \bar{x}_0$ $\underline{u}_0 \leq \Pi_{u_0} u(0) \leq \bar{u}_0,$ $\underline{z}_0 \leq \Pi_{z_0} z(0) \leq \bar{z}_0$

 $x \leq \Pi_x x(t) \leq \bar{x},$

 $u \leq \Pi_u u(t) \leq \bar{u},$

 $z \leq \Pi_z z(t) \leq \bar{z}$,

 $F_T(x(T), z(T), p) = 0,$

 $\underline{x}_T \leq \Pi_{x_T} x(T) \leq \bar{u}_T,$ $z_T \leq \Pi_{z_T} z(T) \leq \bar{z}_T$

Currently not yet implemented features:

• support for soft constraints missing

• constraints cannot depend on algebraic variables (yet)

s.t.