Preparation of Papers for IEEE Sponsored Conferences & Symposia*

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***Abstract*— Write an abstract here.**

I. INTRODUCTION

Write the introduction here.

II. RELATED WORK

A. Model predictive control

List some papers sharing information about model predictive control.

B. Solving optimization problems

Mainly introduce [Fast Model Predictive Control Using Online Optimization by Wang and Boyd] and where some usefull features expending its algorithm are discribed. [1]

III. PROBLEM STATEMENT

A. Description of a Quadratic Program

Introduce the unchanged problem statement of [1]

B. Quadratic Constrained Quadratic Program

If linear constraints as bounds for state and control variable are not sufficient it can be necessary to use nonlinear constraints such as quadratic constraints.

$$z^T \Gamma z + \beta^T z \leq \alpha \tag{1}$$

C. Second Order Cone Program

A more gernal form of contraints are second order cone constraints. An Optimization problem using this type of constraints is called second order cone program. Constraints are described as a second order cone as following: {Description as Cone Definition K:=...} as following inequality:

$$\|Az + b\|_2 \leq c^T z + d \tag{2}$$

D. Soft Constraints

IV. EXTENDED ALGORITHM

A. Generalized Constraints

In the described primal barrier first and second order derivative. A SOCC in the above mentioned form is not continuously differentiable. Therefor SOCC in Generalized form [2] can be used.

$$\|Az + b\|_2^2 \leq \left(c^T z + d\right)^2 \tag{3}$$

B. Extended Problem Statement

The algorithm of [1] shell still be used, therefor its genreal form is not changed. Only the constant matrix P and the vector h, also constant regardingly the optimizationvariable z, are expended with p rows belonging to the p new quadratic constraints und q rows for the conic constraints. Different from the extended vector $\hat{h}$ the extended matrix $\hat{P}(z)$ is not constant regardingly z anymore.

$$\hat{P}(z) = \begin{bmatrix} P \\ \beta_1^T + z^T \Gamma_1 \\ \vdots \\ \beta_p^T + z^T \Gamma_p \\ -\left(c_1^T z + 2d_1\right) c_1^T + \left(z^T A_1^T + 2b_1^T\right) A_1 \\ \vdots \\ -\left(c_q^T z + 2d_q\right) c_q^T + \left(z^T A_q^T + 2b_q^T\right) A_q \end{bmatrix} \tag{4}$$

$$\hat{h} = \begin{bmatrix} h \\ \alpha_1^T \\ \vdots \\ \alpha_p^T \\ d_1^2 - b_1^T b_1 \\ \vdots \\ d_q^2 - b_q^T b_q \end{bmatrix} \tag{5}$$

Expending P and h does not change the structure of Φ exploited in [1]. So we have not to worry go on with its algorithm. With new $\hat{h}$ and $\hat{P}(z)$ the logarithmic barrier function looks like

$$\phi(z) = \sum_{i=1}^{lT+l_f+p+q} -\log\left(\hat{h}_i - \hat{p}_i^T(z) z\right) \tag{6}$$

where $\hat{p}_i^T(z)$ is the ith rows of $\hat{P}(z)$ depending on z. The gradient of the logarithmic barrier function $\nabla\phi(z)$ necessary to calculate the residual is derived simply bei forming $\hat{P}$ with argument $2z$ multiplied by $\hat{d}$.

$$\nabla\phi(z) = \hat{P}^T(2z)\hat{d} \tag{7}$$

with

$$\hat{d}_i = \frac{1}{\hat{h}_i - \hat{p}_i^T(z) z} \tag{8}$$

*This work was not supported by any organization

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To obtain Φ in the resulting system of linear equations two additionel terms have to be added to the Hessian of $\phi(z)$.

$$\begin{aligned}\nabla^2\phi(z) =& \hat{P}(2z)\mathrm{diag}(\hat{d})^2\hat{P}(2z) \\ &+ \sum_{i=lT+lf+1}^{lT+lf+p}\left(\hat{d}_i 2\Gamma_i\right) \\ &+ \sum_{j=lT+lf+p+1}^{lT+lf+p+q}\left(\hat{d}_j - 2\left(c_j c_j^T - A_j^T A_j\right)\right)\end{aligned} \tag{9}$$

C. Selecting κ

In [1] the use of a fixed kappa is proposed. But it is difficult to find one. Eventually it should be considered to calculate a new κ once every time step, not every inner step, proportional to the values in the optimization variable like in [guck nach] for linear programs. Adopted for quadratic programs κ can be estimated as follows

D. Nummerical Improvments

V. RESULTS

A. Test QPs

Results of Solving Test QPs by [3]

B. Application Example

VI. CONCLUSIONS

APPENDIX

Appendixes should appear before the acknowledgment.

ACKNOWLEDGMENT

Acknowledgment.

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