1 Problem

$$\begin{aligned} \min_x & f(x) \\ & g(x) \leq 0 \\ & h(x) = 0 \end{aligned}$$

2 Algorithm

Algorithm 1 Filter Line Search

procedure FILTER LINE SEARCH
loop:
  while True **do**
    $ineq \leftarrow m_g(x^k)$
    $active \leftarrow [i] : m_g(x^k)_i \geq -\tau$
    $c \leftarrow [m_h(x^k); m_g(x^k)_{active}]$
    $A \leftarrow [\nabla m_h(x^k); \nabla m_g(x^k)_{active}]$
    $G \leftarrow \nabla m_f(x^k)$
    $H \leftarrow \nabla^2 f(x^k)$
    $\theta \leftarrow \theta(x^k)$
    if check stopping criteria with model functions at x^k **then**
      if $r > \tau$ **then**
        $r \leftarrow \gamma_{dec} r$
        improve model
        continue.
      return success
    $KKT \leftarrow [H, A^T; A, 0]$
    $rhs \leftarrow [G; c]$
    if $cond(KKT) > maxconidition$ **then**
      restore feasibility
      continue
    $[d; \_] = -KKT^{-1} rhs$
    α_{min} = compute minimum alpha
    $\alpha = 1$
    $accept = False$
    while $notaccept$ **do**
      $m \leftarrow \alpha G^T d$
      Variant: clip to trust region
      if $\alpha < \alpha_{min}$ **then**
        restore feasibility
        goto *loop*
      $x_{new} = x + \alpha * d$
      $\theta_{new} = \theta(x_{new})$
      $f_{new} = m_f(x_{new})$
      if new inequality constraint becomes active **then**
        $\alpha = \tau\alpha$
        continue
      plot model
      if $[f_new, \theta_{new}]$ is dominated **then**
        $\alpha = \tau\alpha$
        continue
      $ftype \leftarrow m < 0 \wedge (-m)^{s_f} \alpha^{1-s_f} > \delta\theta^{s_\theta}$
      if $ftype$ **then**
        if $f_{new} \leq f + \eta_f m$ **then**
          $accept \leftarrow True$
        else
          $\alpha = \tau\alpha$
          continue
      else
        check equation 8
      $\alpha = \tau\alpha$
    if $accept$ **then**

      $rho \leftarrow$ compute rho
      if rho is small **then**
        if $\|x_new - center\| < \frac{1}{2} r$ **then**
          $r \leftarrow \gamma_{dec} r$
        else
          $r \leftarrow \gamma_{inc} r$
        improve the model
      else if rho is medium **then**
        if lambda poised **then**
          $r \leftarrow \gamma_{dec} r$
        improve the model
      elsecontinue
      if $(1 - \gamma_\theta) * \theta_{new} > tol$ **then** add to filter: $[f_{new} - \gamma_f \theta_{new}, (1 - constants.gamma_theta)\theta_{new}]$
      $x^{k+1} \leftarrow x_{new}$
      construct model functions m_f, m_h, m_g
  goto *top*.