Manual of MLCP_ReSNA

— ReSNA Plugin for Mixed Linear Complementarity Problems —

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1 Problem

`MLCP_ReSNA.m` solves (tries to solve) the Mixed Linear Complementarity Problem (MLCP) expressed as follows:

$$
\begin{aligned}
\text{Find} \quad & (x, y, p) \in \mathbb{R}^n \times \mathbb{R}^n \times \mathbb{R}^l \\
\text{such that} \quad & x \geq 0, \; y \geq 0, \; x^\top y = 0, \\
& y = M_{11}x + M_{12}p + q_1, \;\; M_{21}x + M_{22}p + q_2 = 0,
\end{aligned}
\tag{1.1}
$$

where $M_{11} \in \mathbb{R}^{n \times n}$, $M_{12} \in \mathbb{R}^{n \times l}$, $M_{21} \in \mathbb{R}^{l \times n}$, $M_{22} \in \mathbb{R}^{l \times l}$, $q_1 \in \mathbb{R}^n$ and $q_2 \in \mathbb{R}^l$ are given matrices and vectors.

2 How to use the plugin

Putting `ReSNA.m` in the same folder, you can use `MLCP_ReSNA.m` as follows.

$$
\begin{aligned}
&\text{Usage 1:} \quad \text{[x,y,p] = MLCP\_ReSNA(M,q,el)} \\
&\text{Usage 2:} \quad \text{[x,y,p] = MLCP\_ReSNA(M,q,el,x0,y0,p0)}
\end{aligned}
$$

- `M` — implies the matrix $M \in \mathbb{R}^{(n+l) \times (n+l)}$ such that

$$
M = \begin{pmatrix} M_{11} & M_{12} \\ M_{21} & M_{22} \end{pmatrix}.
$$

- `q` — implies the vector $q \in \mathbb{R}^{n+l}$ such that

$$
q = \begin{pmatrix} q_1 \\ q_2 \end{pmatrix}.
$$

- `el` — implies the value of l, i.e., the dimension of p and q_2 in problem (1.1). `el` should be given as a nonnegative integer. If M_{12}, M_{21}, M_{22}, q_2 and p are absent (non-mixed case), let `el = 0`.

- `x0` — implies the initial point $x^{(0)}$ for the regularized smoothing Newton algorithm (Algorithm 4.1 in `manual_ReSNA.pdf`). `x0` should be given as a column vector whose length is equal to `length(q)-el`. If you omit `x0` or let `x0 = []`, then ReSNA chooses a random vector from $[-1, 1]^n$ automatically.

- `y0` — implies the initial point $y^{(0)}$, which can be omitted similarly to `x0`.

- `p0` — implies the initial point $p^{(0)}$ for the regularized smoothing Newton algorithm. `p0` should be given as a column vector whose length is equal to `el`. If you omit `p0` or let `p0 = []`, then ReSNA chooses a random vector from $[-1, 1]^l$ automatically.

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Parameters in `ReSNA.m`

- `PROGRESS` — decides whether or not ReSNA displays the detailed progress of the iteration. The default value is `'Y'`.

- `tole` — is used for the termination criterion in Step 1 (Algorithm 4.1 in `manual_ReSNA.pdf`). When $\|H_{\mathrm{NR}}(w^{(k)})\| \leq$ `tole`, the algorithm terminates normally and the obtained output is guaranteed to be the solution of problem (1.1). The default value is `1e-8`.

- `tole_diff` — is used for approximating the Jacobian matrix by means of the finite difference method. The default value is `1e-8`. (This parameter is not used for this plugin.)

- `eta, eta_bar, rho, sigma, kappa, kappa_bar, kappa_hat` — are the parameters indicated in Algorithm 4.1 in `manual_ReSNA.pdf`. Some default values are assigned automatically.