

Manual of NCP_ReSNA

— ReSNA Plugin for Nonlinear Complementarity Problems —

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1 Problem

`NCP_ReSNA.m` solves (tries to solve) the Nonlinear Complementarity Problem (NCP) expressed as follows:

$$\begin{aligned} \text{Find } & (x, y) \in \mathbb{R}^n \times \mathbb{R}^n \\ \text{such that } & x \geq 0, y \geq 0, x^\top y = 0, \\ & y = F(x), \end{aligned} \tag{1.1}$$

where $F : \mathbb{R}^n \rightarrow \mathbb{R}^n$ is a given continuously differentiable function.

2 How to use the plugin

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

Usage 1: `[x,y] = NCP_ReSNA(FUNC,nabFUNC,n)`

Usage 2: `[x,y] = NCP_ReSNA(FUNC,nabFUNC,n,x0,y0)`

- `FUNC` — implies the function $F : \mathbb{R}^n \rightarrow \mathbb{R}^n$ in problem (1.1). If function m-file `F.m` plays a role of function F , then put `F.m` in the same folder and let `FUNC=@F`. (“at mark” is required before the name of function m-file.)
- `nabFUNC` — implies $\nabla F : \mathbb{R}^n \rightarrow \mathbb{R}^{n \times n}$, i.e., the transposed Jacobian of function F . If function m-file `nabF.m` plays a role of function ∇F , then put `nabF.m` in the same folder and let `nabFUNC=@nabF`. If you do not have the closed form of $\nabla F(x)$, let `nabFUNC=[]`. In this case, $\nabla F(x)$ is approximated by means of the finite difference method.
- `n` — implies the value of n , i.e., the dimension of x or $F(x)$ in problem (1.1). `n` should be given as a positive integer.
- `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 `n`. 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`.

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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 $\|H_{\text{NR}}(w^{(k)})\| \leq \text{tole}$, 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`.
- `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.