

Algorithm 2 Newton's method

Input:

\mathbf{x}_0 , vector of length N with initial approximation

tol, tolerance: stop if $\|\mathbf{x}_{k+1} - \mathbf{x}_k\| < \text{tol}$

k_{\max} , maximum number of iterations: stop if $k > k_{\max}$

Output:

\mathbf{x}_k , approximation of solution of $F(\mathbf{x}) = \mathbf{0}$ within tolerance tol or with $k = k_{\max}$ steps.

Steps:

$k \leftarrow 0$

while $k \leq k_{\max}$ **do**

 Calculate $F(\mathbf{x}_k)$ and $N \times N$ matrix $J(\mathbf{x}_k)$

 Solve the $N \times N$ linear system $J(\mathbf{x}_k) \mathbf{z} = -F(\mathbf{x}_k)$

$\mathbf{x}_{k+1} \leftarrow \mathbf{x}_k + \mathbf{z}$

if $\|\mathbf{z}\| < \text{tol}$ **then**

break

end if

$k \leftarrow k + 1$

end while
