
NETWORKDYNAMICS.JL

JACOBIAN VECTOR PRODUCT

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Explicit Solvers

$$x_{k+1} = F(x_k)$$

Implicit Solvers

$$G(x_k, x_{k+1}) = 0$$

$$g(x_{k+1}) = 0$$

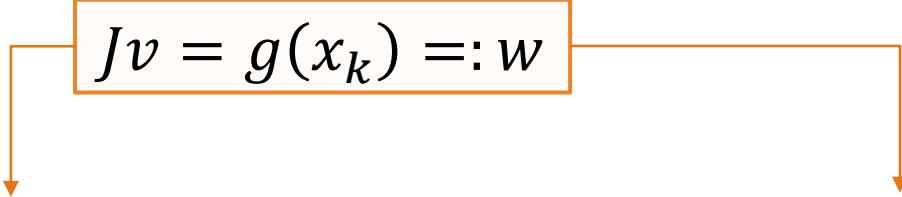
Rootfinding problem

$$x_{k+1} = x_k - J(x_k)^{-1}g(x_k)$$

Newton Method

1. Solve $Jv = g(x_k) =: w$

2. Update $x_{k+1} = x_k - v$


$$Jv = g(x_k) =: w$$

I) Find Jacobian

$$v = J^{-1}w$$

memory problems

2) Use Jacobian Vector Product (JVP)

$$Jv = w$$

$$w_i = \sum_j^m J_{ij} v_j \Leftrightarrow w_i = \sum_j^m \frac{df_i}{dx_j} v_j = \nabla f_i(x) v$$

$$Jv = \nabla f v$$

$$Jv = \lim_{\epsilon \rightarrow 0} \frac{f(x + v\epsilon) - f(x)}{\epsilon}$$

$$Jv \approx \frac{f(x + v\epsilon) - f(x)}{\epsilon} \quad \epsilon \neq 0$$