

Automatic Differentiation, Adjoint, and Sensitivities

Felix Matteo Köhler

1. [Adjoint Equation of a Linear System of Equations - by implicit derivative](#)
2. [Adjoint Sensitivities of a Linear System of Equations - derived using the Lagrangian](#)
3. [Python Example for the Adjoint Sensitivities of a Linear System Full Details & Timings](#)
4. [Adjoint Sensitivities of a Non-Linear system of equations Full Derivation](#)
5. [Lagrangian Perspective on the Derivation of Adjoint Sensitivities of Nonlinear Systems](#)
6. [Python Example for Adjoint Sensitivities of Nonlinear Equation](#)
7. [Adjoint State Method for an ODE Adjoint Sensitivity Analysis](#)
8. [Adjoint Sensitivities over nonlinear equation with JAX Automatic Differentiation](#)
9. [Adjoint Sensitivities in Julia with Zygote & ChainRules](#)
10. [Python Example Adjoint Sensitivities over nonlinear SYSTEMS of equations](#)
11. [Using JAX Jacobians for Adjoint Sensitivities over Nonlinear Systems of Equations](#)
12. [What is a Jacobian-Vector product \(jvp\) in JAX](#)
13. [Naive Jacobian-vector product vs. JAX.jvp Benchmark comparison](#)
14. [What is a vector-Jacobian product \(vjp\) in JAX](#)
15. [Naive vector-Jacobian product vs JAX.vjp Benchmark comparison](#)
16. [Jacobian-vector product \(Jvp\) with ForwardDiff.jl in Julia](#)
17. [What is a Pullback in Zygote.jl vector-Jacobian products in Julia](#)
18. [Full Jacobian Matrix using forward-mode AD in JAX](#)
19. [Full Jacobian using reverse-mode AD in JAX](#)
20. [Materials](#)

September 3, 2025