

$$\tilde{\nabla} \Phi_D(x_k) = \nabla_x f(x_k, y_k^D) - \nabla_x \nabla_y g(x_k, y_k^D) [\nabla_y^2 g(x_k, y_k^D)]^{-1} \nabla_y f(x_k, y_k^D).$$