Online Optimization with  $b_k$  = sine-sine+ramp-mixed and constant Hessian  $10^{2}$ 10<sup>0</sup> Tracking error 10-2 Online gradient Control-based Sys ID ARX  $10^{-4}$ Control-based Baseline Known b k version  $10^{-6}$ 10-8  $10^{-10}$ 200 400 600 800 1000 Time