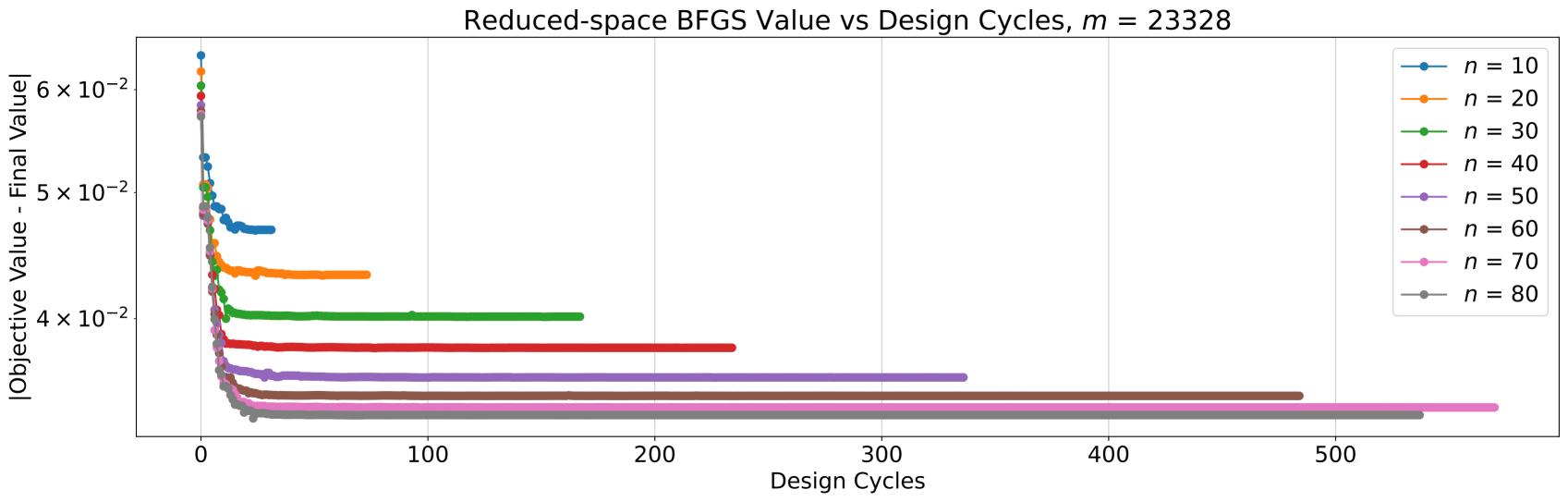
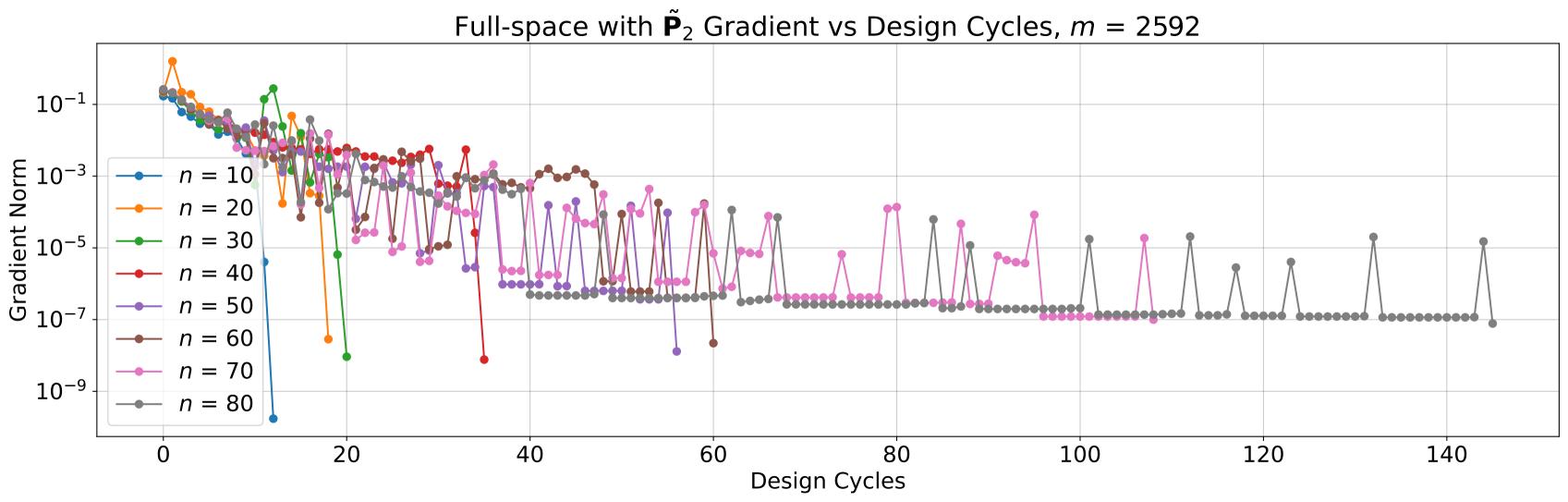
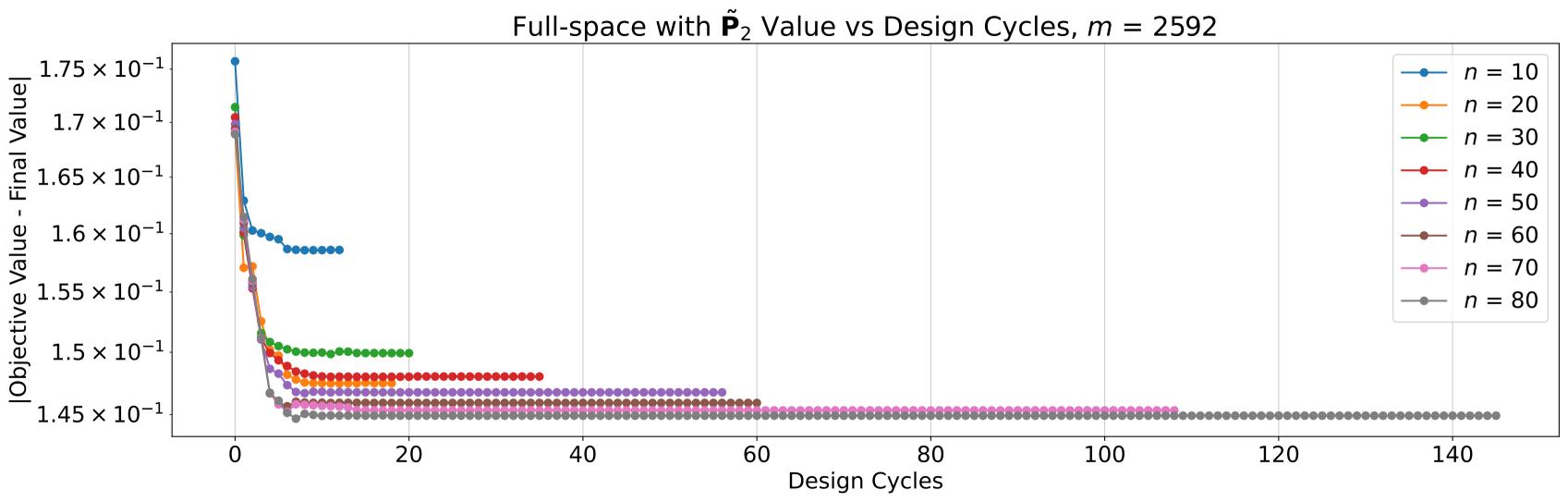
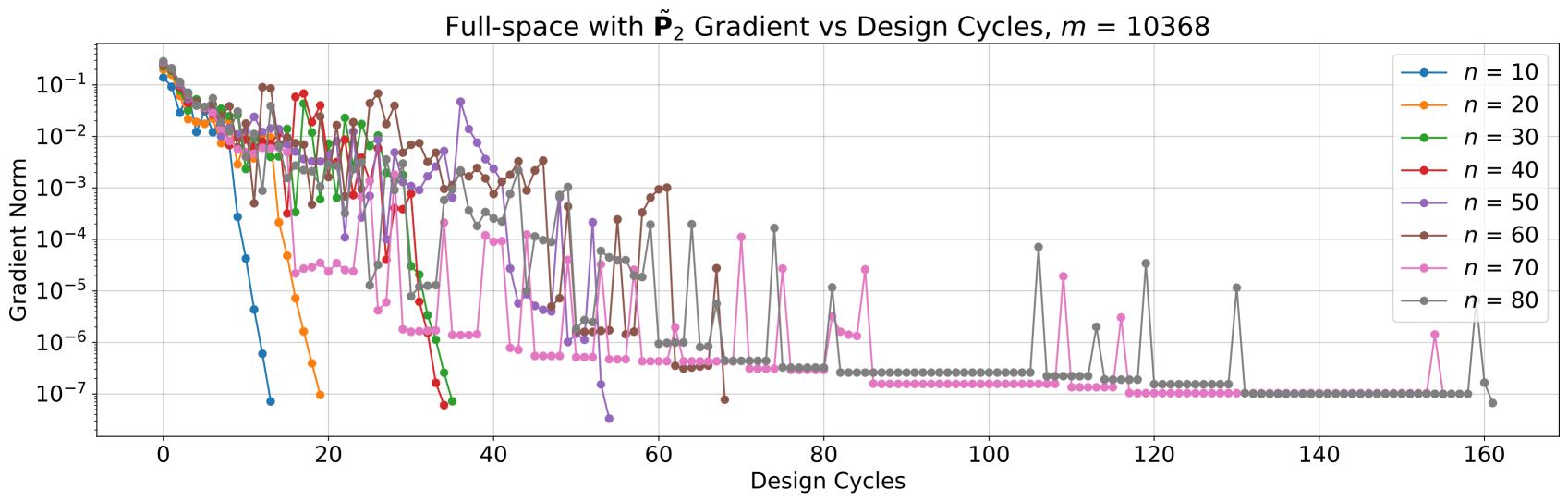


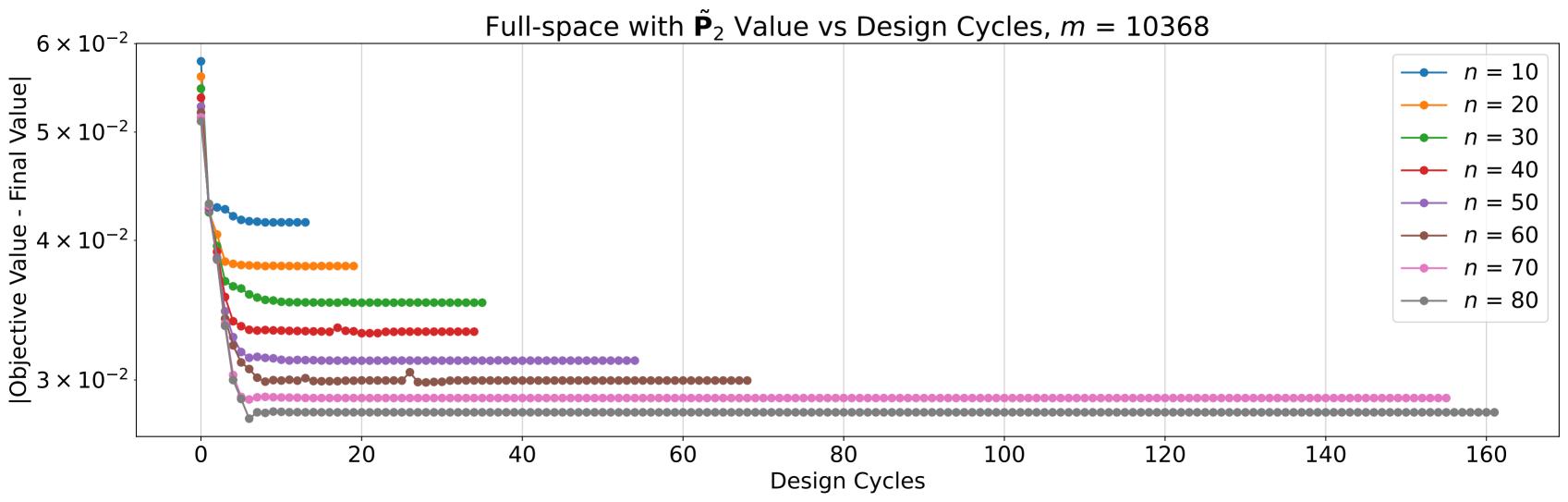
Reduced-space BFGS Gradient vs Design Cycles, m = 23328 \rightarrow n = 10 10^{-1} --- n = 20-- n = 30-- n = 40و الم Gradient -2 5 \rightarrow n = 60n = 70n = 80 10^{-7} 100 200 300 400 500 **Design Cycles**

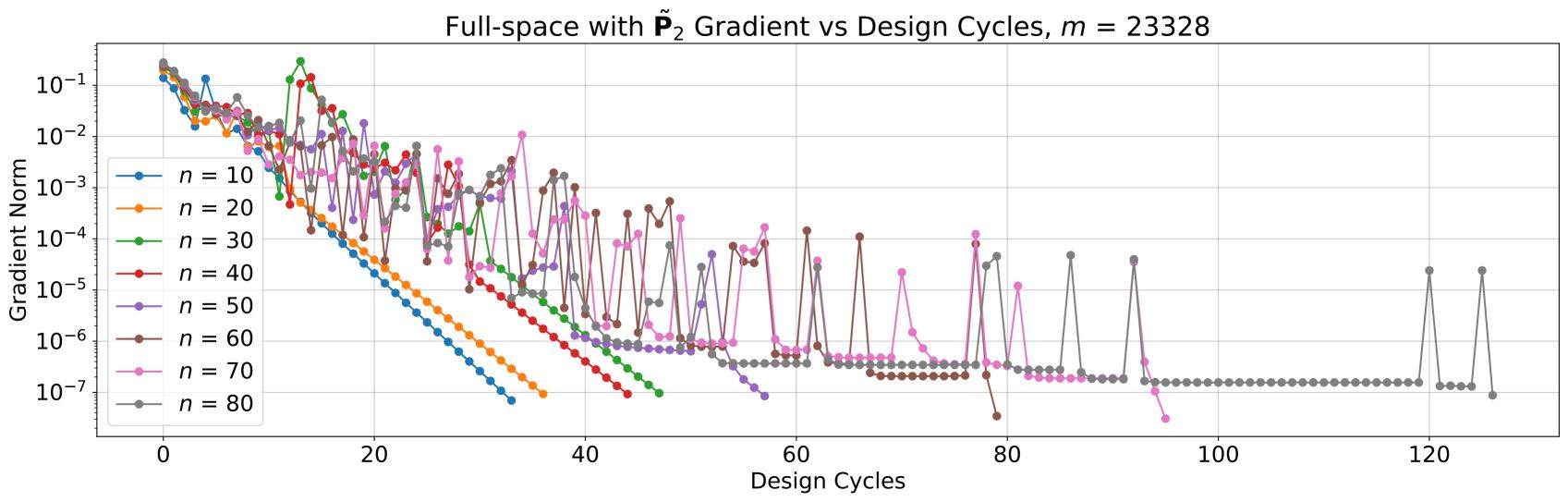


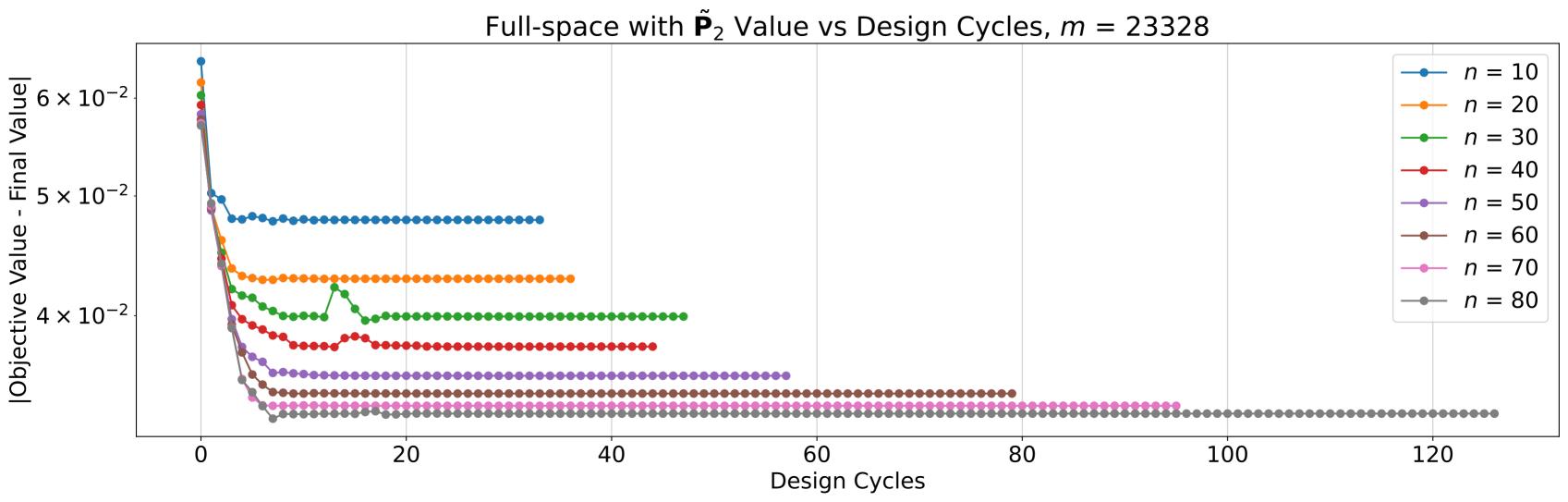








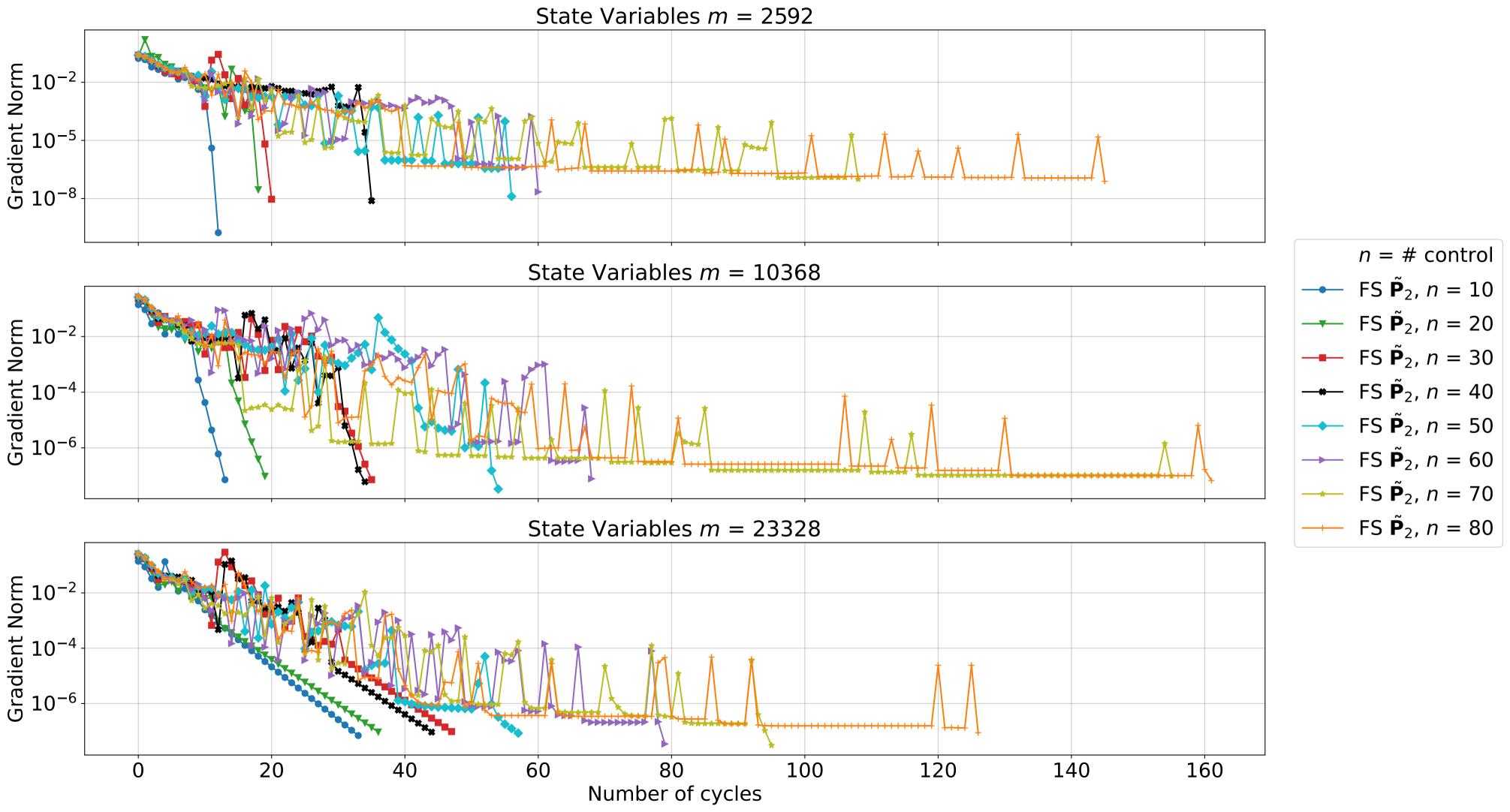


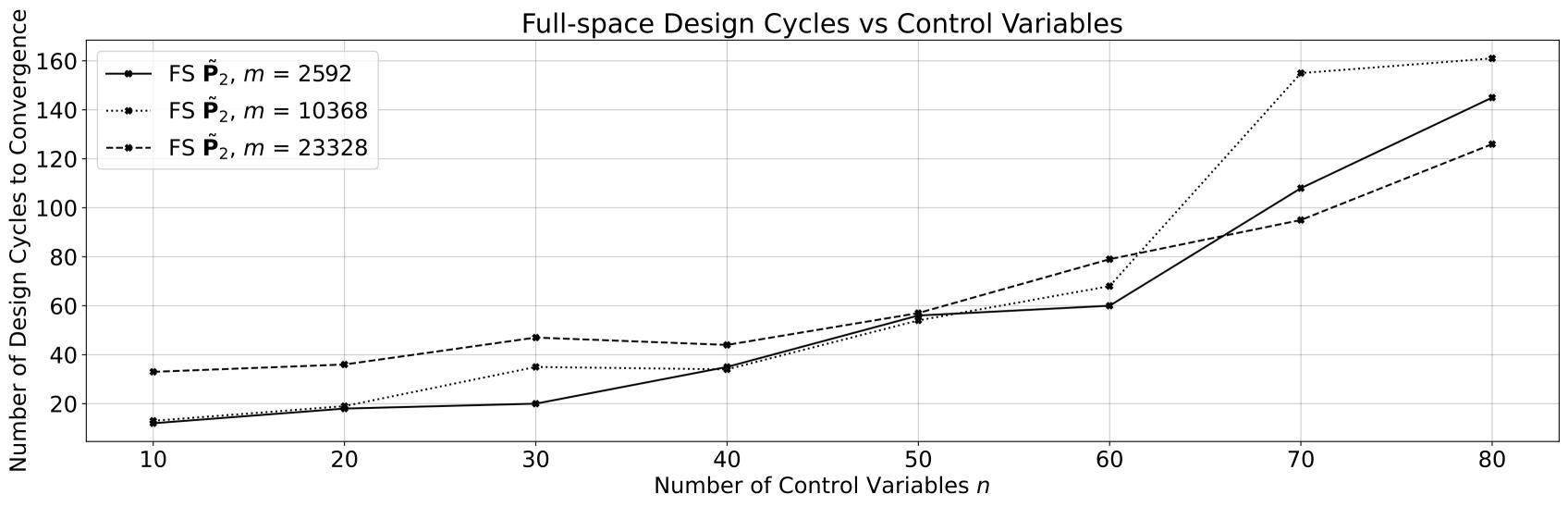


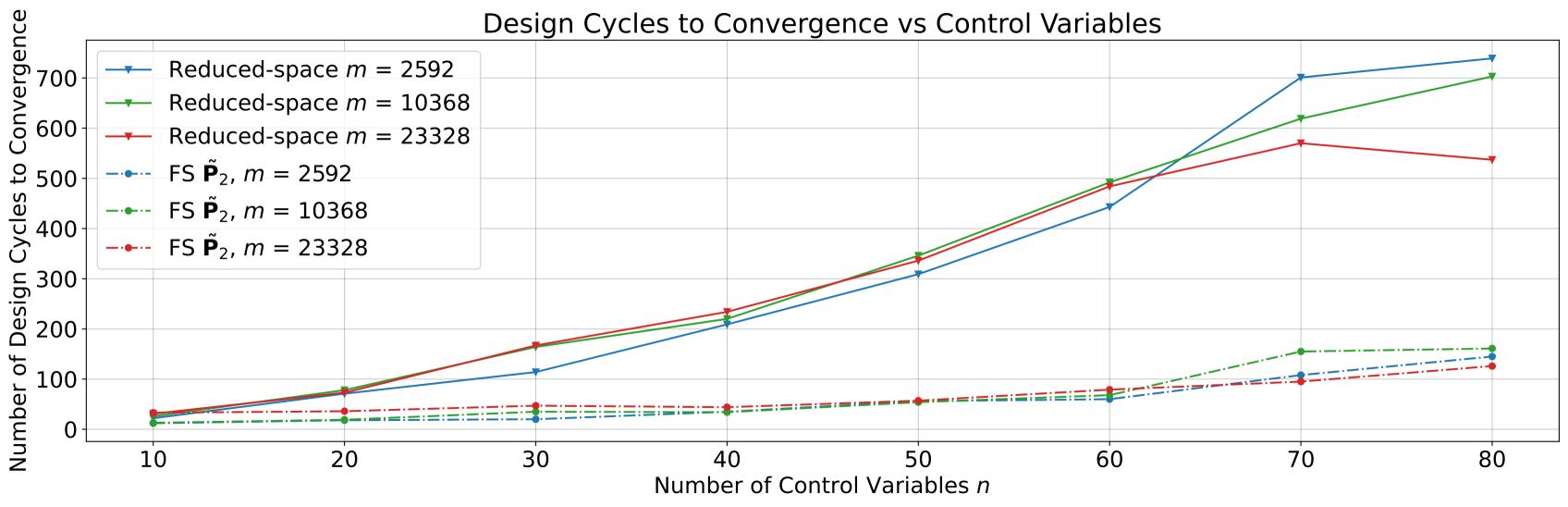
Full-space Gradient vs Design Cyles, m = 2592 \longrightarrow FS $\tilde{\mathbf{P}}_2$, n=10 10^{-1} \rightarrow FS $\tilde{\mathbf{P}}_2$, n = 20-- FS $\tilde{\mathbf{P}}_2$, n = 30Radient Norm 10⁻³ 10⁻⁷ \longrightarrow FS $\tilde{\mathbf{P}}_2$, n = 40 \rightarrow FS $\tilde{\mathbf{P}}_2$, n = 50 \rightarrow FS $\tilde{\mathbf{P}}_2$, n = 60 \rightarrow FS $\tilde{\mathbf{P}}_2$, n = 70 \longrightarrow FS $\tilde{\mathbf{P}}_2$, n = 80 10^{-9} 140 20 60 80 40 100 120 Number of Subiterations

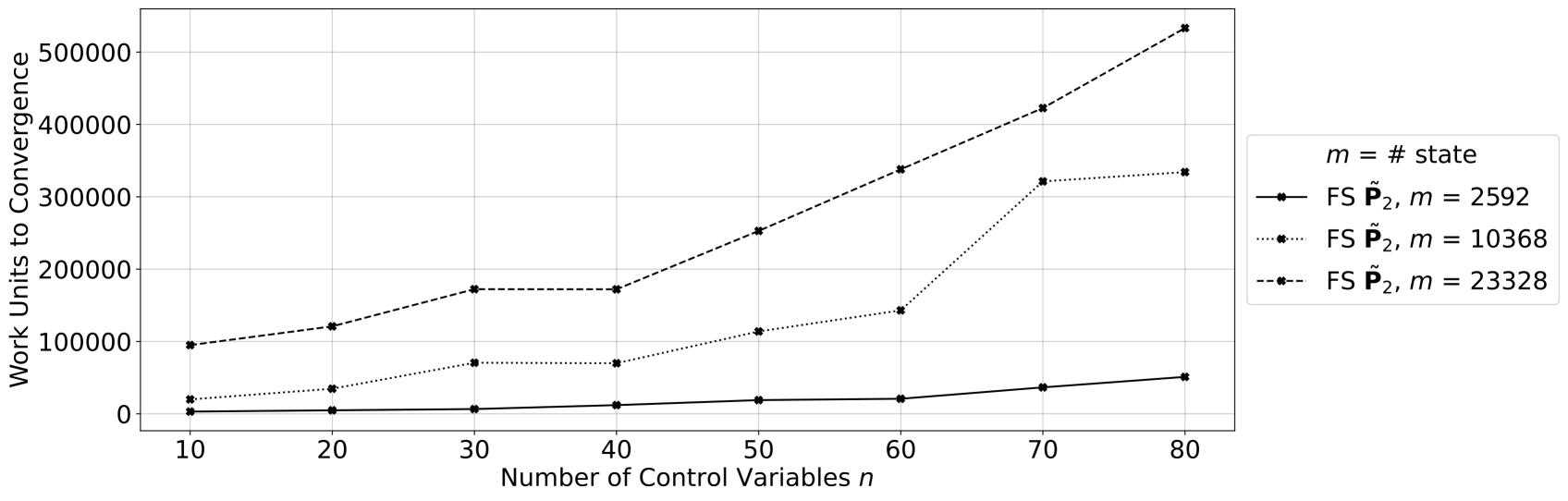
Full-space Gradient vs Design Cyles, m = 10368 \rightarrow FS $\tilde{\mathbf{P}}_2$, n=10 10^{-1} \rightarrow FS $\tilde{\mathbf{P}}_2$, n=20 10^{-2} - FS $\tilde{\mathbf{P}}_2$, n = 30E 10⁻³ -- FS $\tilde{\mathbf{P}}_2$, n = 40 \rightarrow FS $\tilde{\mathbf{P}}_2$, n = 509 digital digi \rightarrow FS $\tilde{\mathbf{P}}_2$, n = 60 \rightarrow FS $\tilde{\mathbf{P}}_2$, n = 70 \rightarrow FS $\tilde{\mathbf{P}}_2$, n = 80 10^{-6} 10^{-7} 20 40 60 80 100 120 140 160 Number of Subiterations

Full-space Gradient vs Design Cyles, m = 23328 \rightarrow FS $\tilde{\mathbf{P}}_2$, n = 10 10^{-1} \rightarrow FS $\tilde{\mathbf{P}}_2$, n = 20 10^{-2} - FS $\tilde{\mathbf{P}}_2$, n = 30E 10⁻³ - FS $\tilde{\mathbf{P}}_2$, n = 40 \rightarrow FS $\tilde{\mathbf{P}}_2$, n = 50- diadient 10⁻⁴ 10⁻⁵ \rightarrow FS $\tilde{\mathbf{P}}_2$, n = 60 \rightarrow FS $\tilde{\mathbf{P}}_2$, n = 70 \rightarrow FS $\tilde{\mathbf{P}}_2$, n = 80 10^{-6} 10^{-7} 20 40 60 80 100 120 **Number of Subiterations**

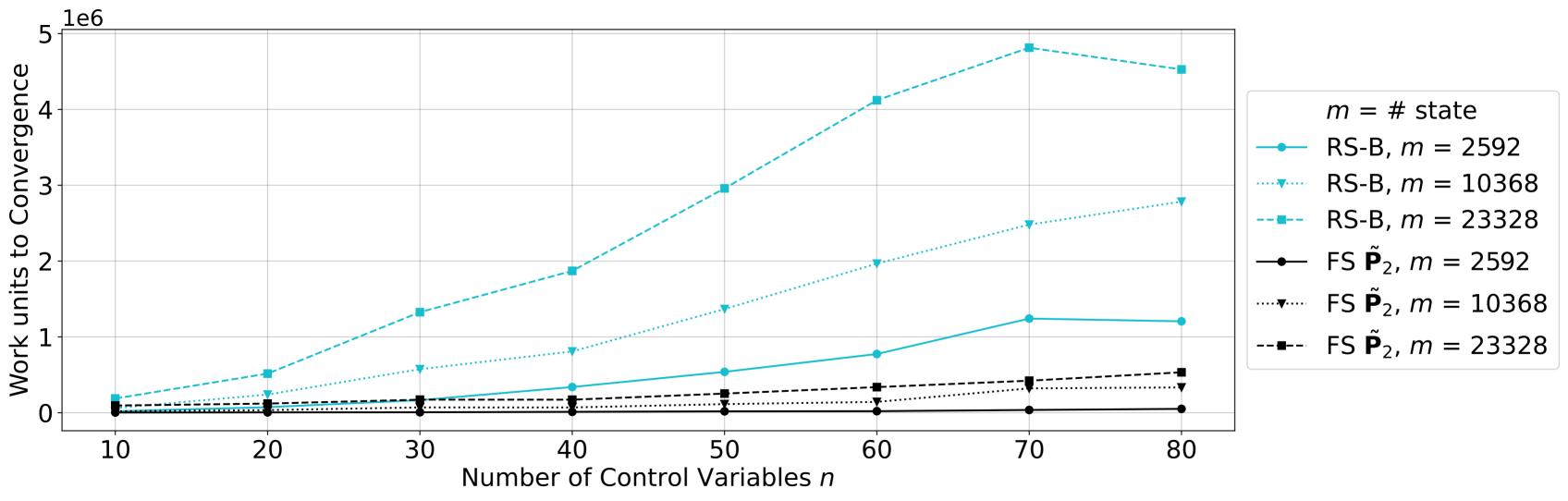


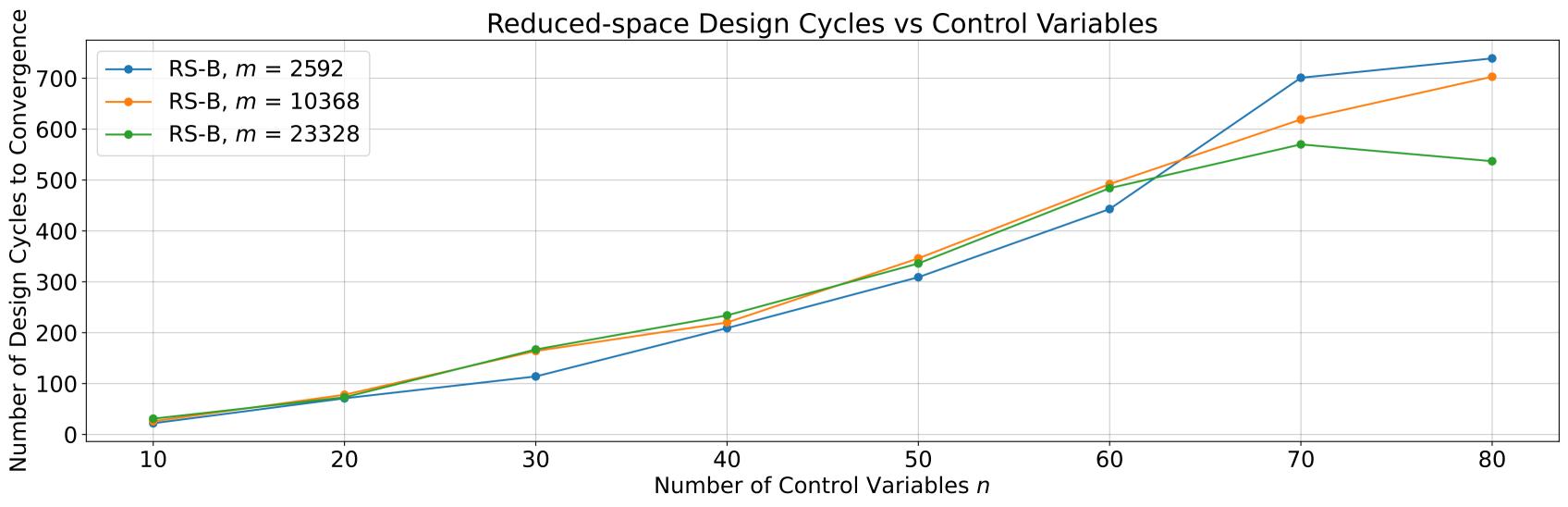


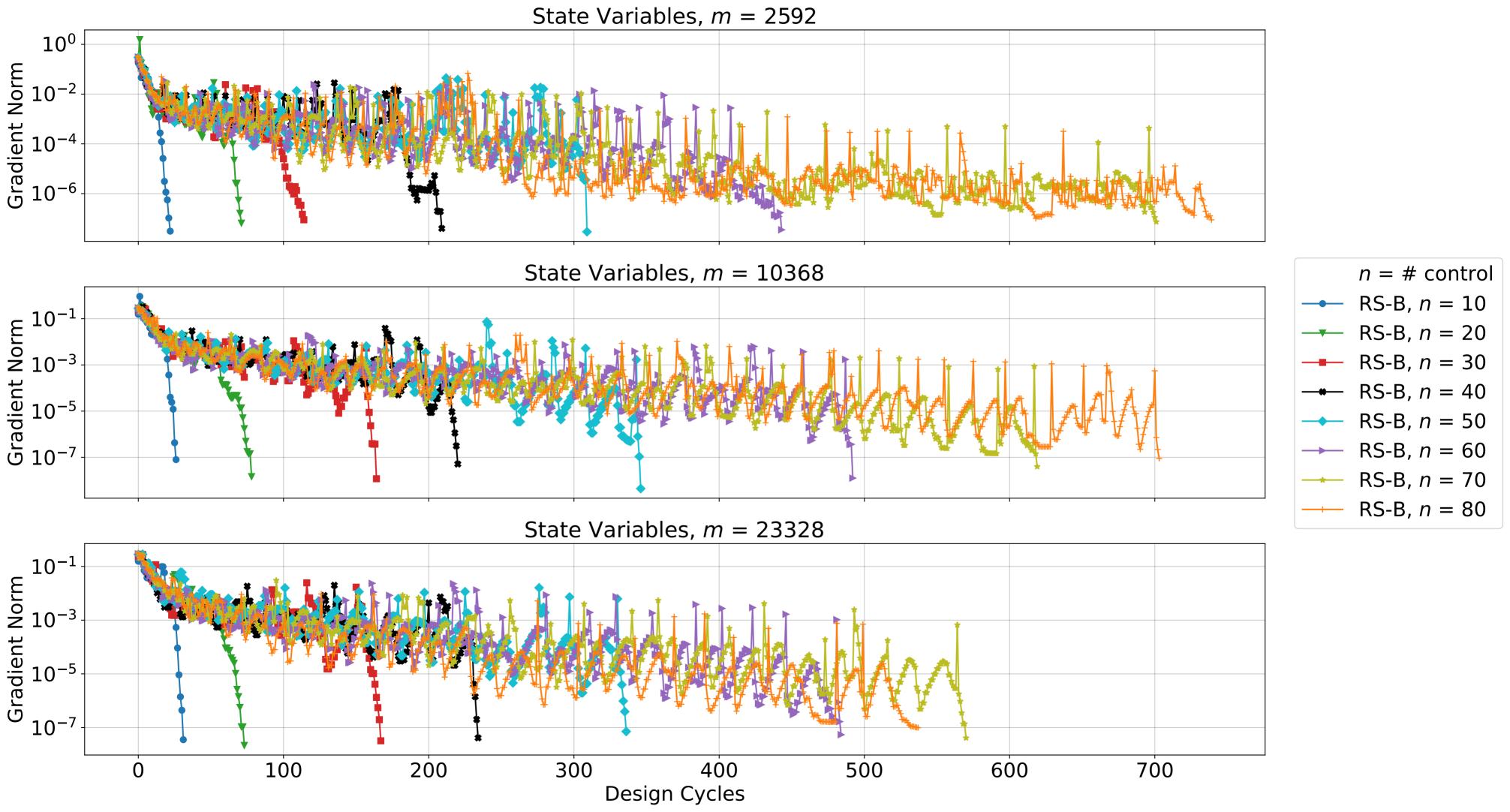


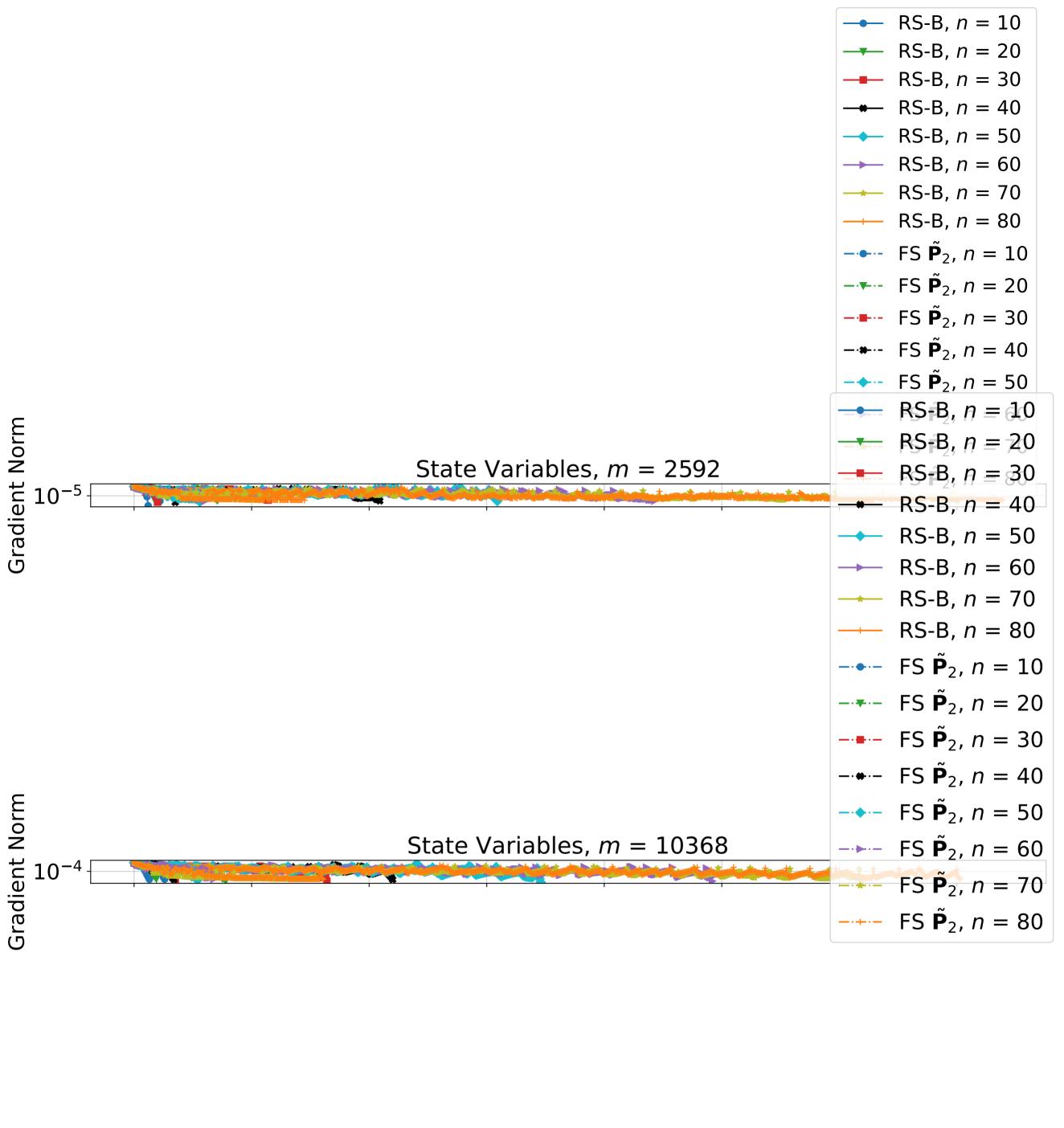


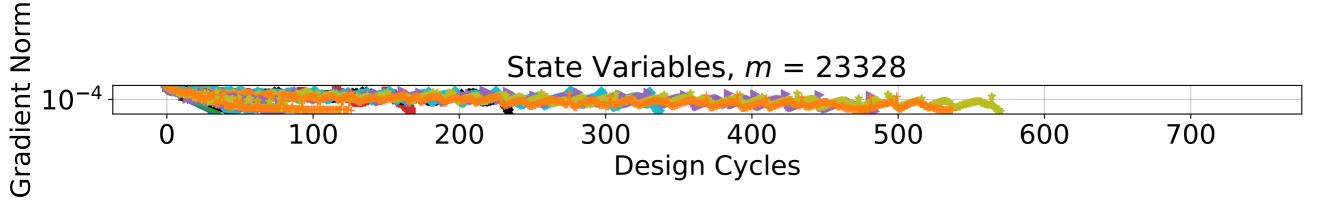
Total Subiterations vs Control Variables 30000 - 2000000 - 20000 - 20000 - 20000 - 20000 - 20000 - 20000 - 20000 - 2000 - FS $\tilde{\mathbf{P}}_2$, m = 2592FS $\tilde{\mathbf{P}}_2$, m = 10368--*-- FS $\tilde{\mathbf{P}}_2$, m = 2332830 10 20 40 50 60 Number of Control Variables *n*

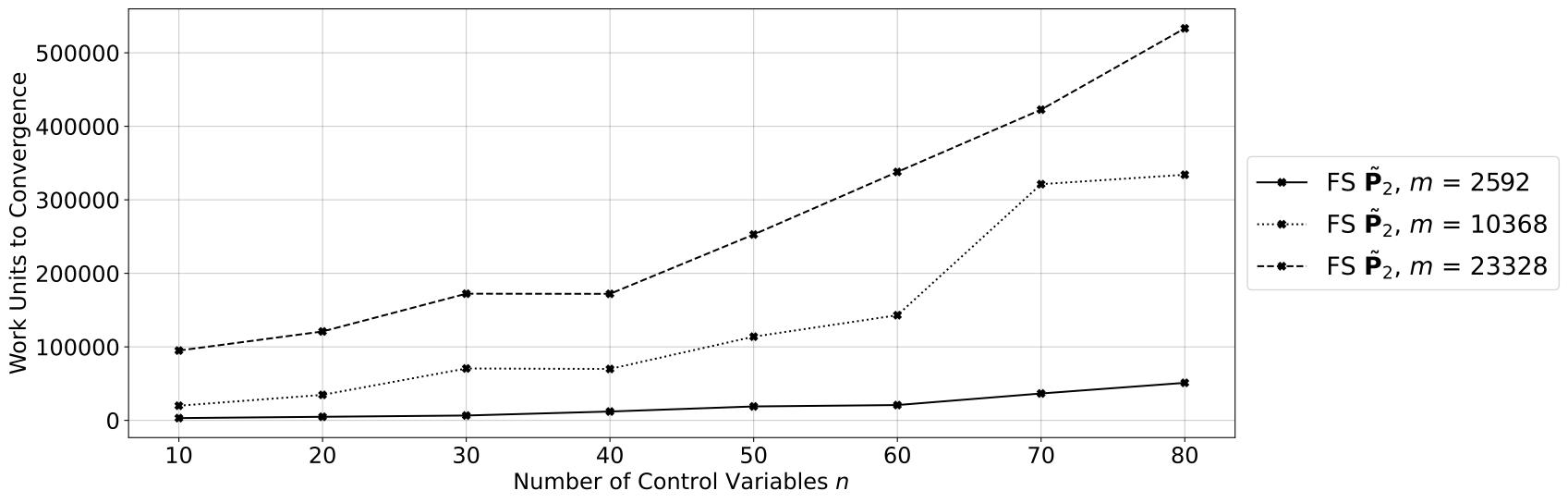


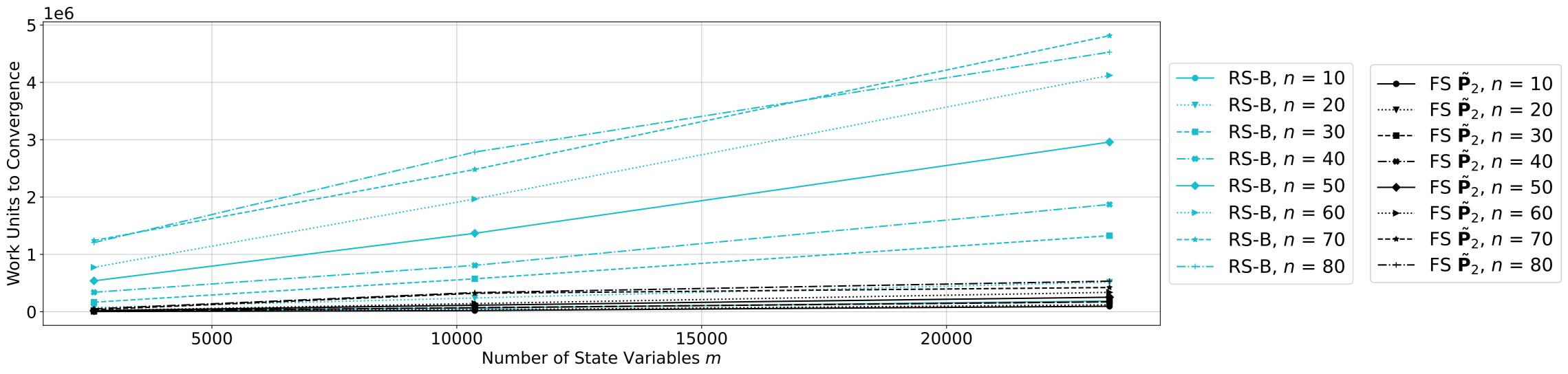












Gradient Norm vs Design Cycles m = 10368

