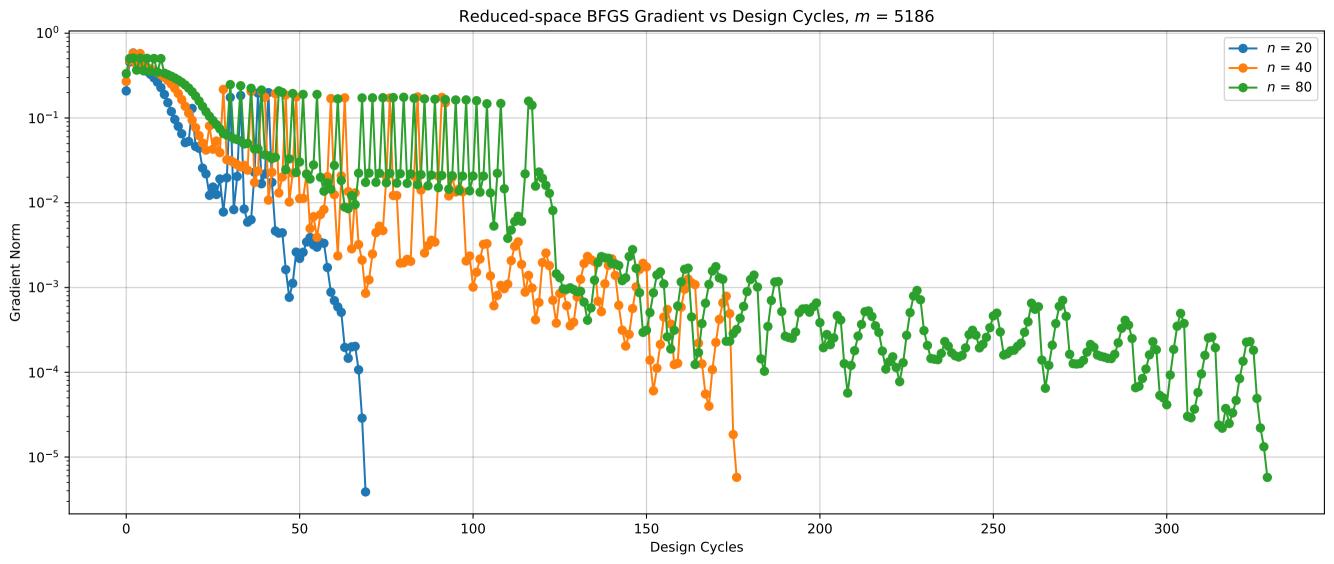
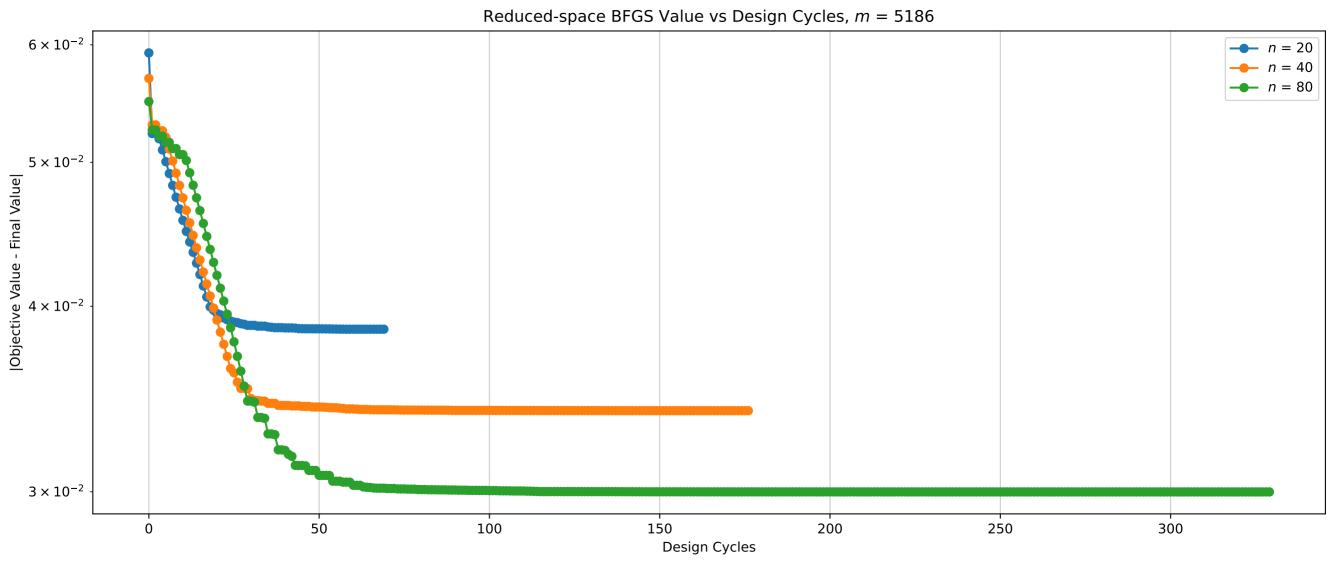
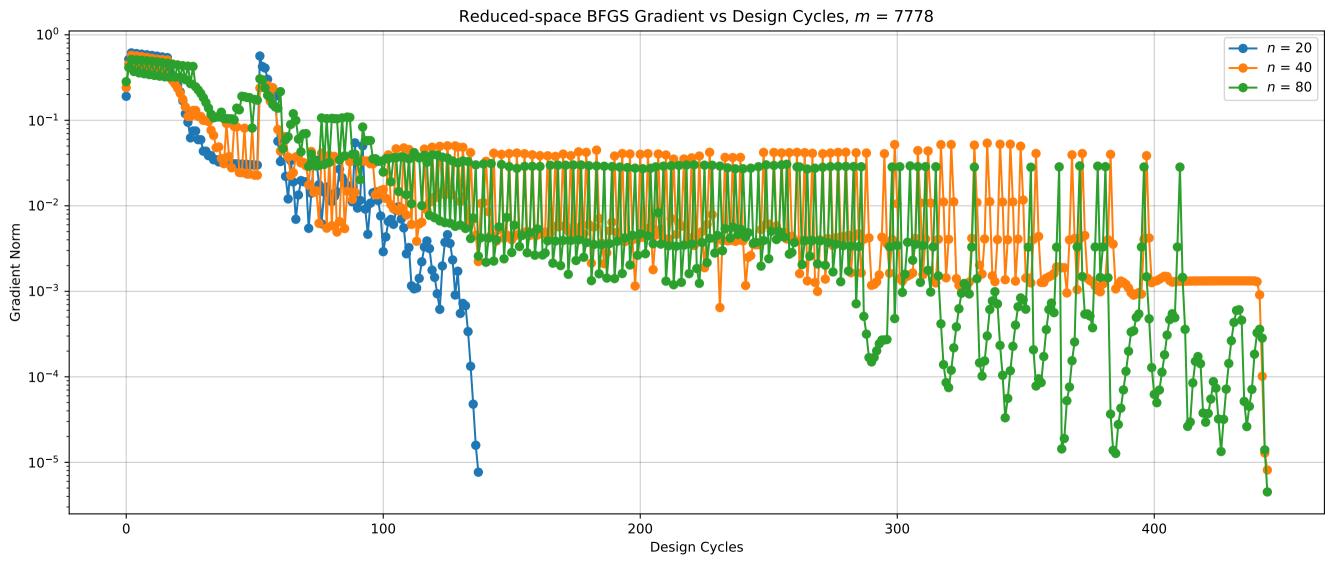
Reduced-space BFGS Gradient vs Design Cycles, m = 2594--- n = 20 10^{1} --- n = 8010⁰ 10^{-1} Gradient Norm 10^{-3} 10^{-4} 10^{-5} 120 20 40 60 80 100 140 160 Design Cycles

Reduced-space BFGS Value vs Design Cycles, m = 2594 1.7×10^{-1} --- n = 20--- n = 40---- n = 80 1.65×10^{-1} 1.6×10^{-1} 1.6 × 10⁻¹ A $\frac{1}{100}$ No. $\frac{1}{100}$ No 1.4×10^{-1} 40 20 60 80 100 120 140 160

Design Cycles







Reduced-space BFGS Value vs Design Cycles, m = 7778--- n = 20--- n = 40--- n = 80 3×10^{-2} 200 100 300 400 **Design Cycles**

Full-space with $\tilde{\mathbf{P}}_2$ Gradient vs Design Cycles, m=2594 10^{0} --- n = 80 10^{-2} Gradient Norm 10^{-6} 10^{-8} 30 50 10 20 60 70 Design Cycles

Full-space with $\tilde{\mathbf{P}}_2$ Value vs Design Cycles, m=2594 1.7×10^{-1} --- n = 20-- n = 40--- n = 80 1.65×10^{-1} 1.6×10^{-1} 1.6 × 10⁻¹ Alne Value 1.4×10^{-1} 10 50 20 30 40 60 70 **Design Cycles**

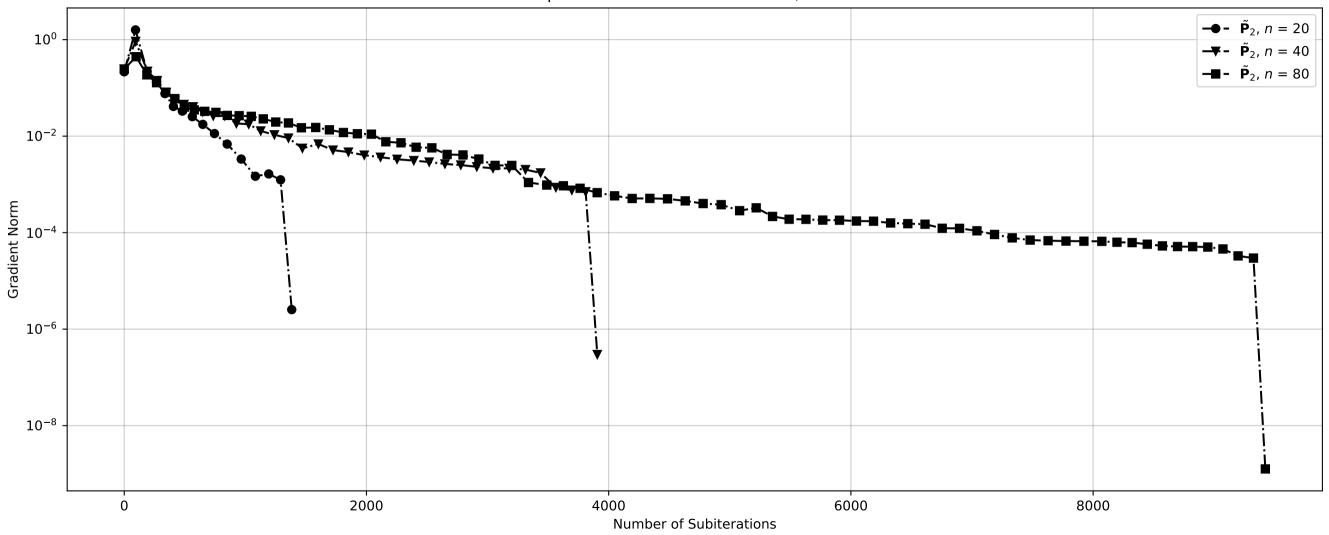
Full-space with $\tilde{\mathbf{P}}_2$ Gradient vs Design Cycles, m=5186 10^{0} - n = 40--- n = 80 10^{-1} 10^{-2} Gradient Norm 10^{-3} 10^{-5} 10^{-6} 10^{-7} 40 80 100 20 60 120 Design Cycles

Full-space with $\tilde{\mathbf{P}}_2$ Value vs Design Cycles, m=5186 6×10^{-2} --- n = 80 5×10^{-2} Objective Value - Final Value | 2 × 10-5 × 1 3×10^{-2} 20 60 80 100 120 **Design Cycles**

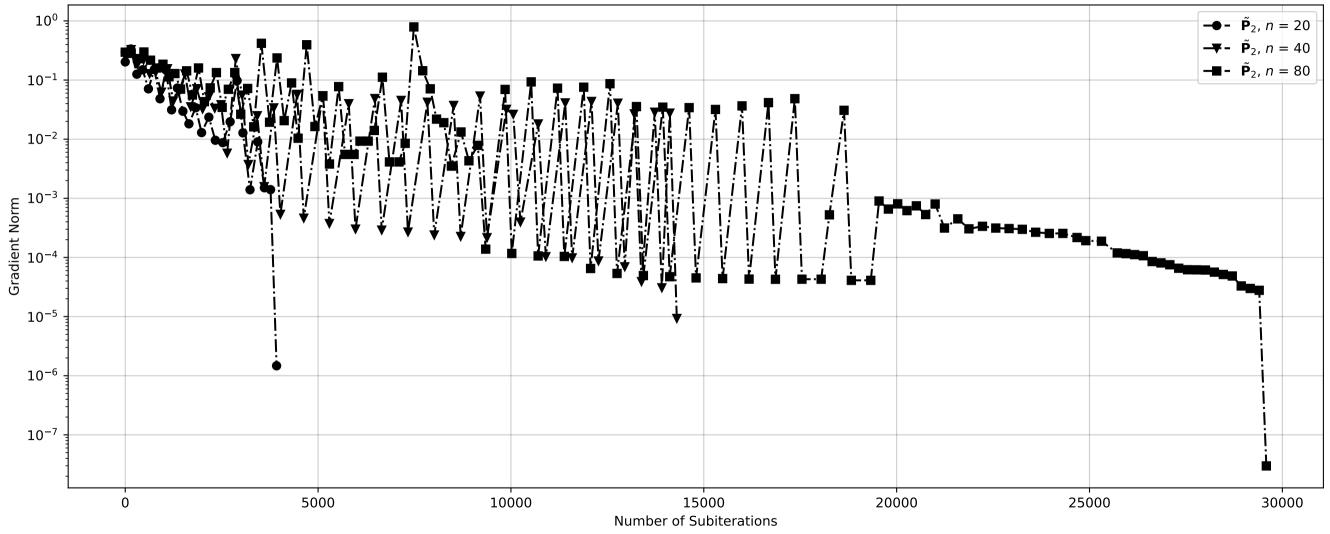
Full-space with $\tilde{\mathbf{P}}_2$ Gradient vs Design Cycles, m=7778 10^{1} --- n = 80 10^{0} 10^{-1} Gradient Norm 10⁻³ 10^{-4} 10^{-5} 10^{-6} 20 60 100 40 80 Design Cycles

Full-space with $\tilde{\mathbf{P}}_2$ Value vs Design Cycles, m=7778--- n = 40--- n = 80 3×10^{-2} |Objective Value - Final Value | S | X | O | O 20 100 **Design Cycles**

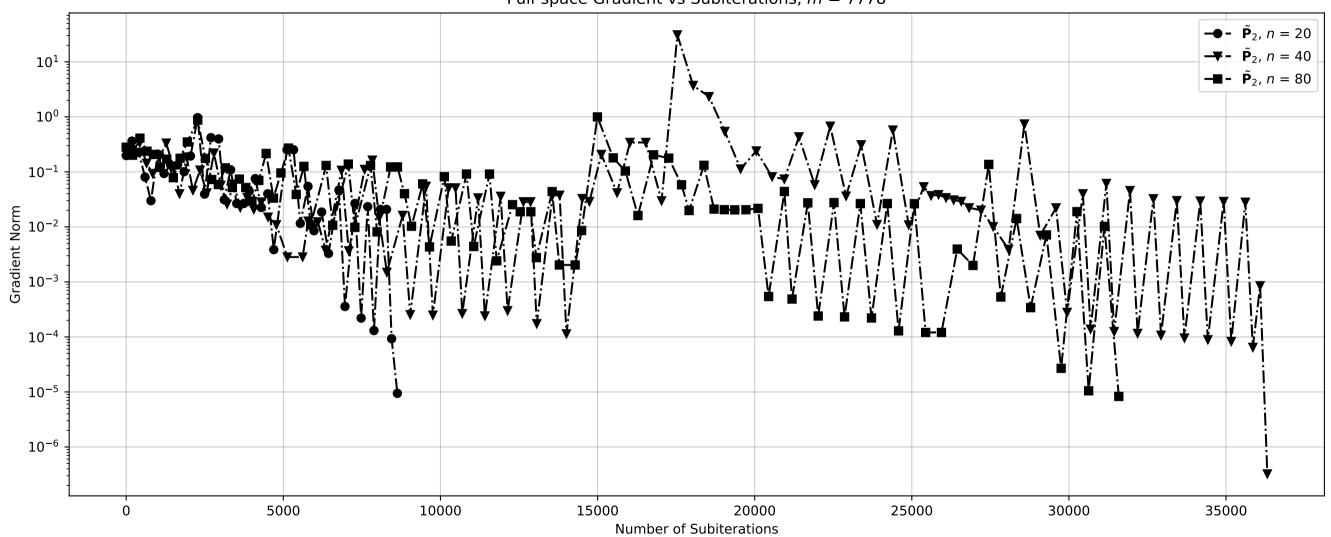
Full-space Gradient vs Subiterations, m = 2594

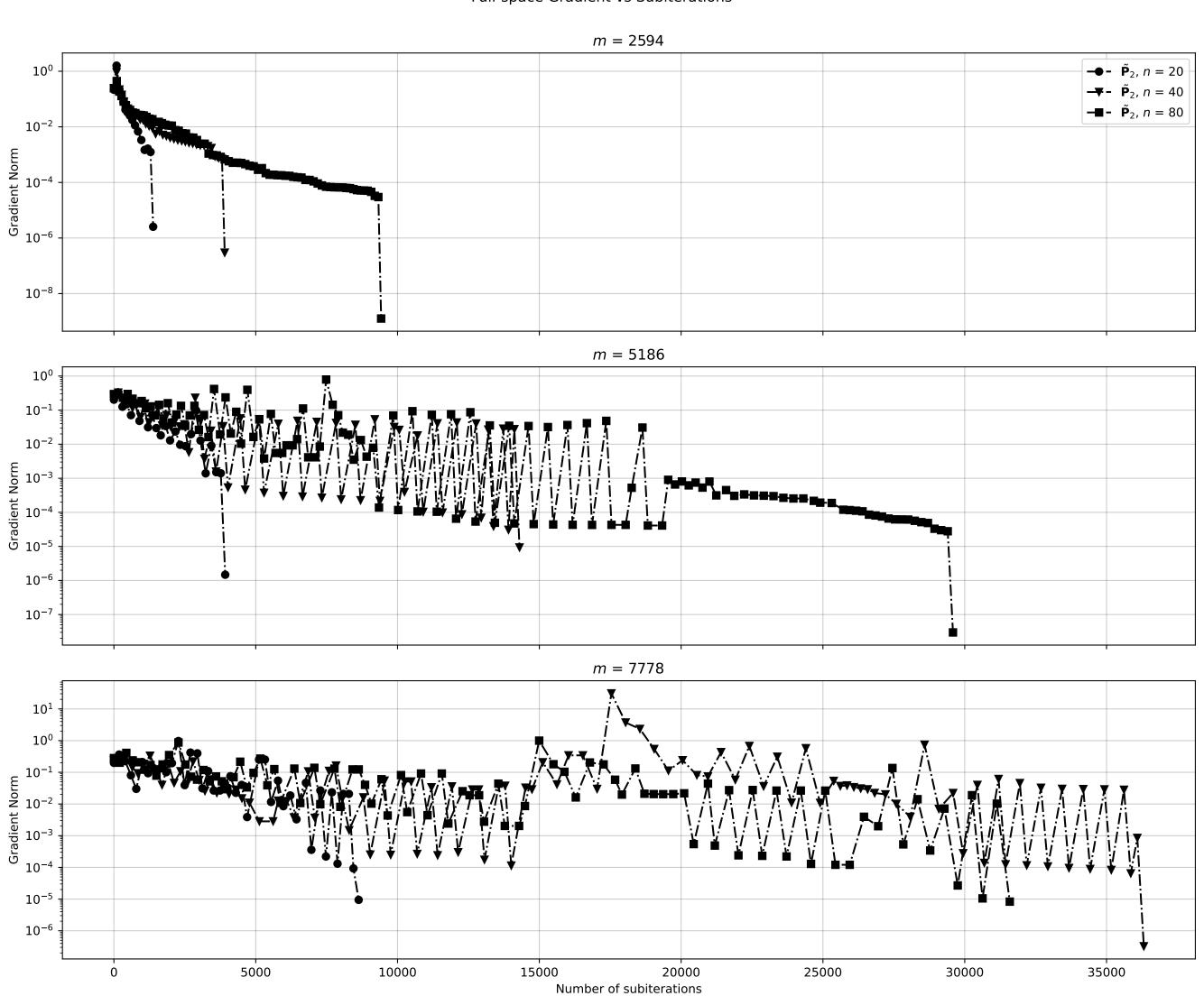


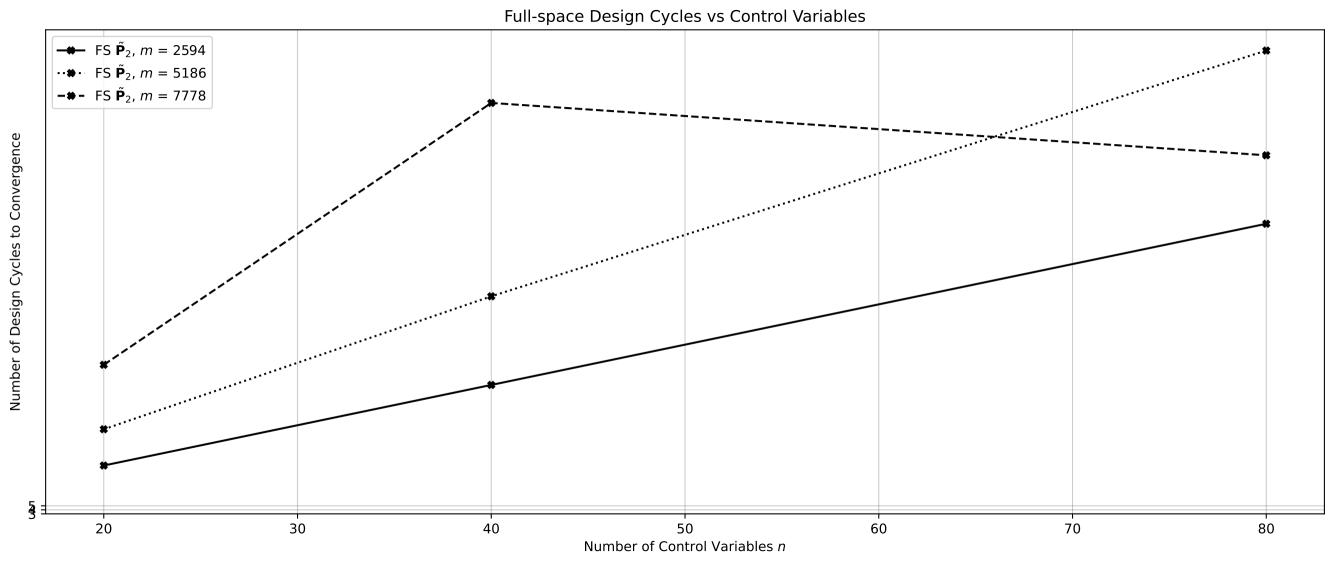
Full-space Gradient vs Subiterations, m=5186

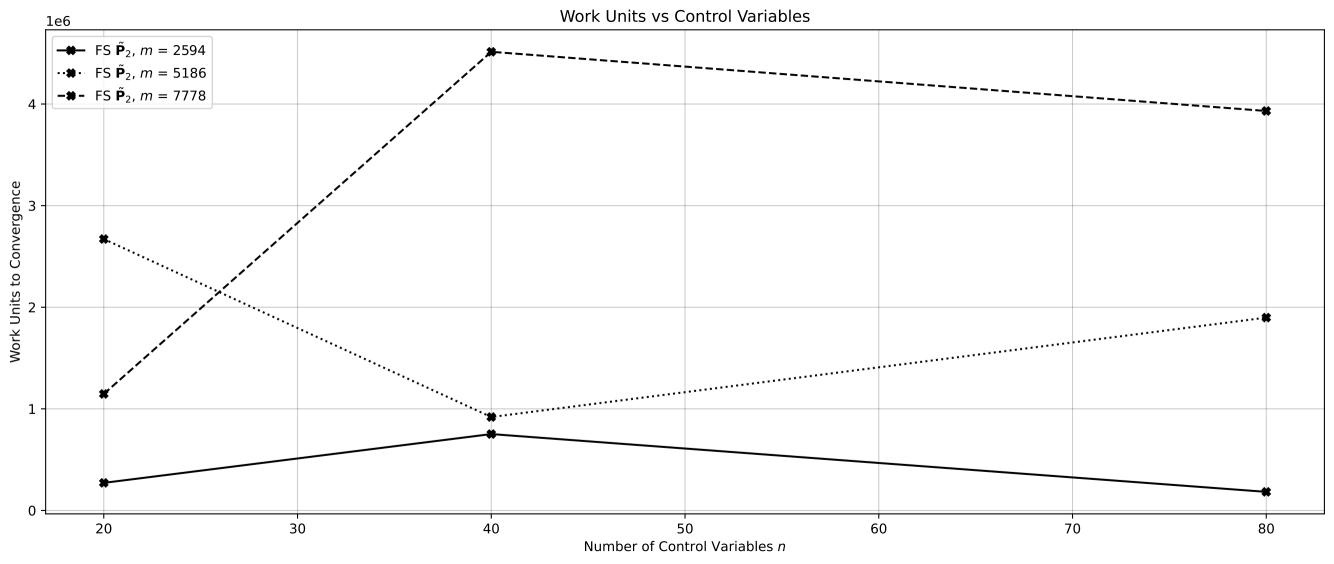


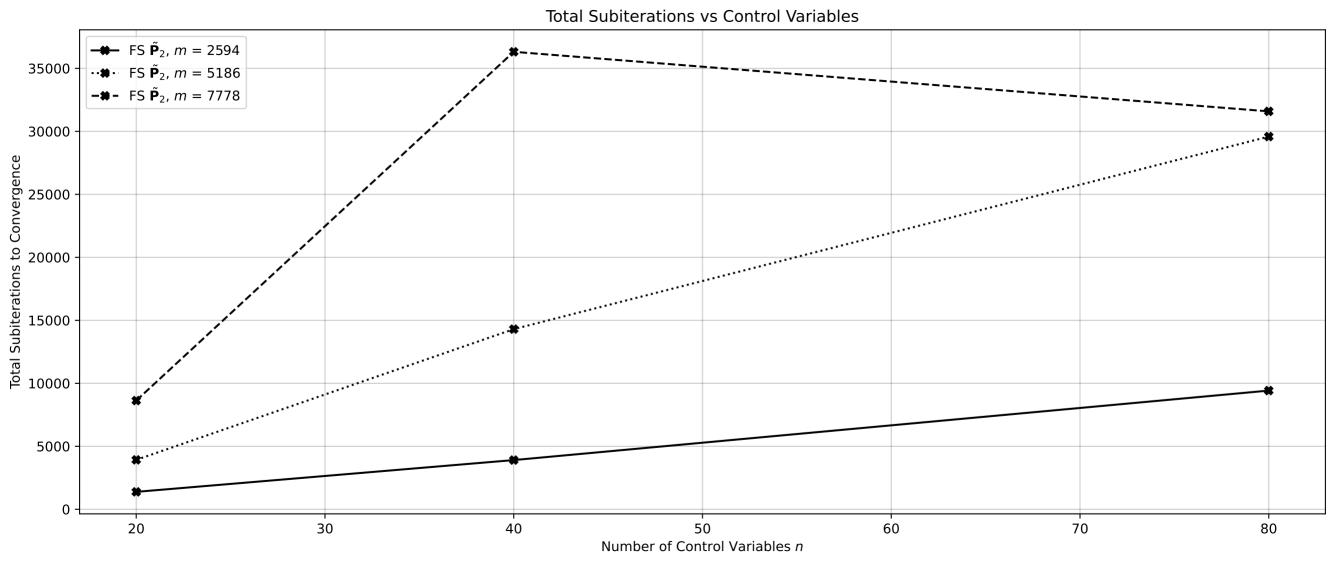
Full-space Gradient vs Subiterations, m = 7778

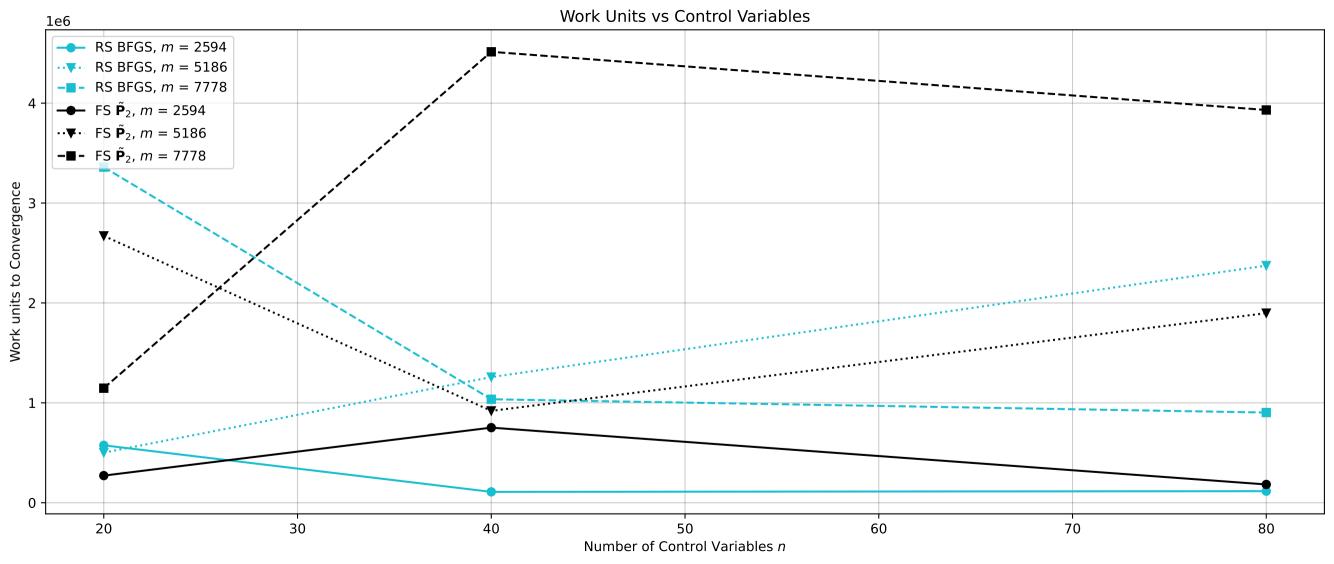


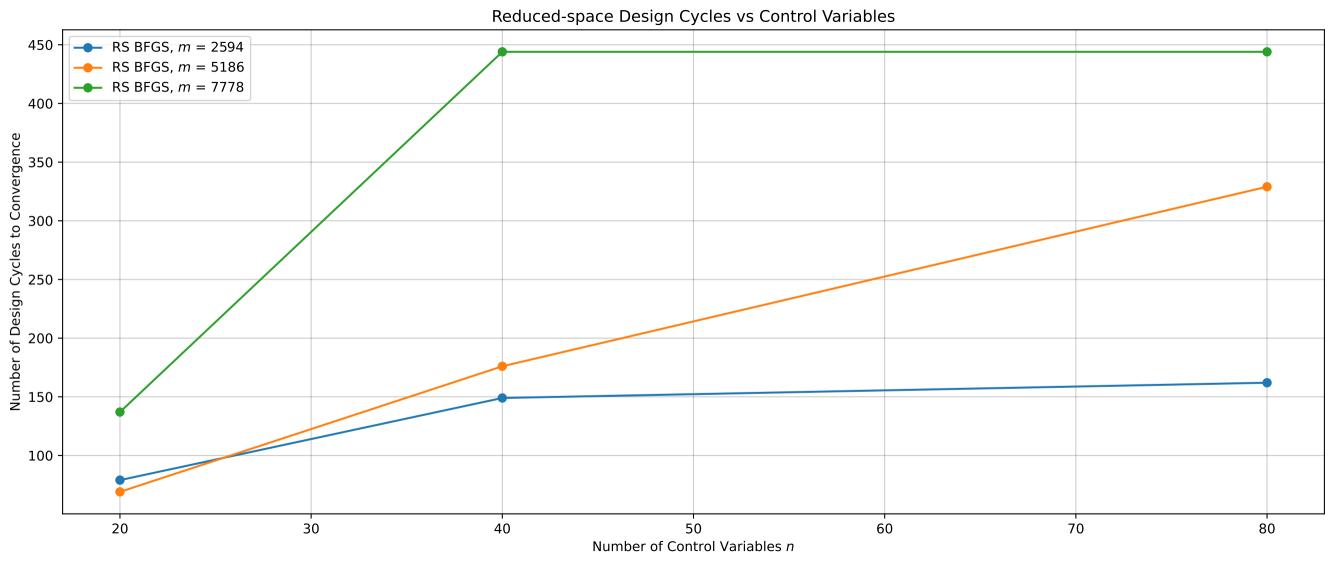


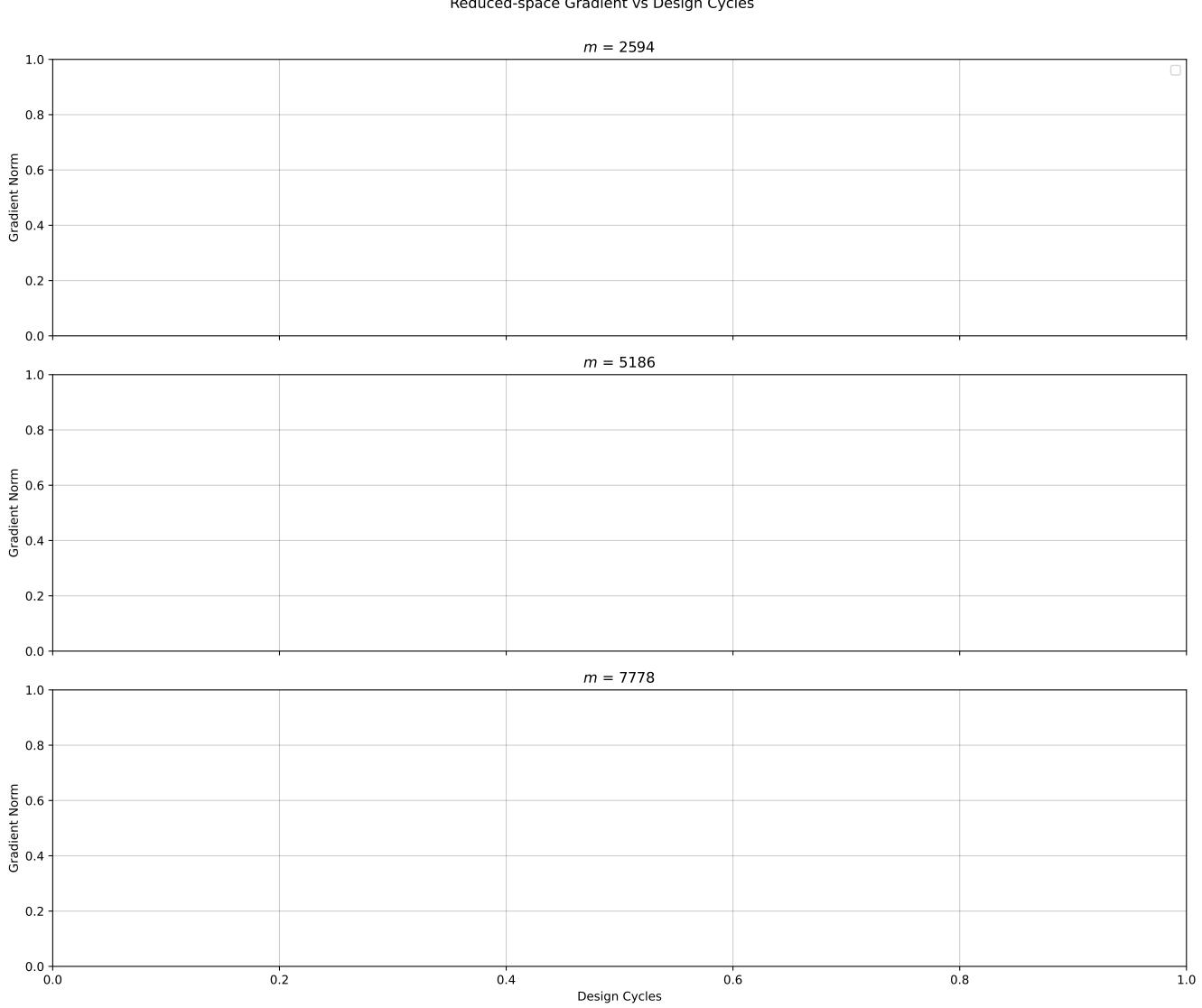


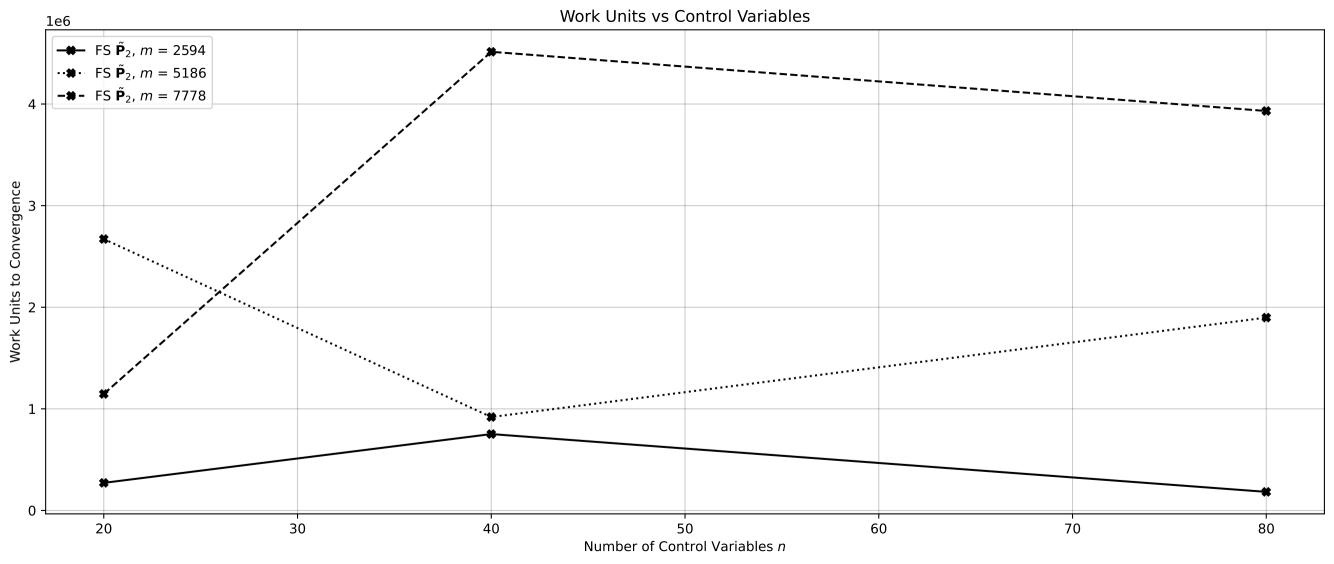


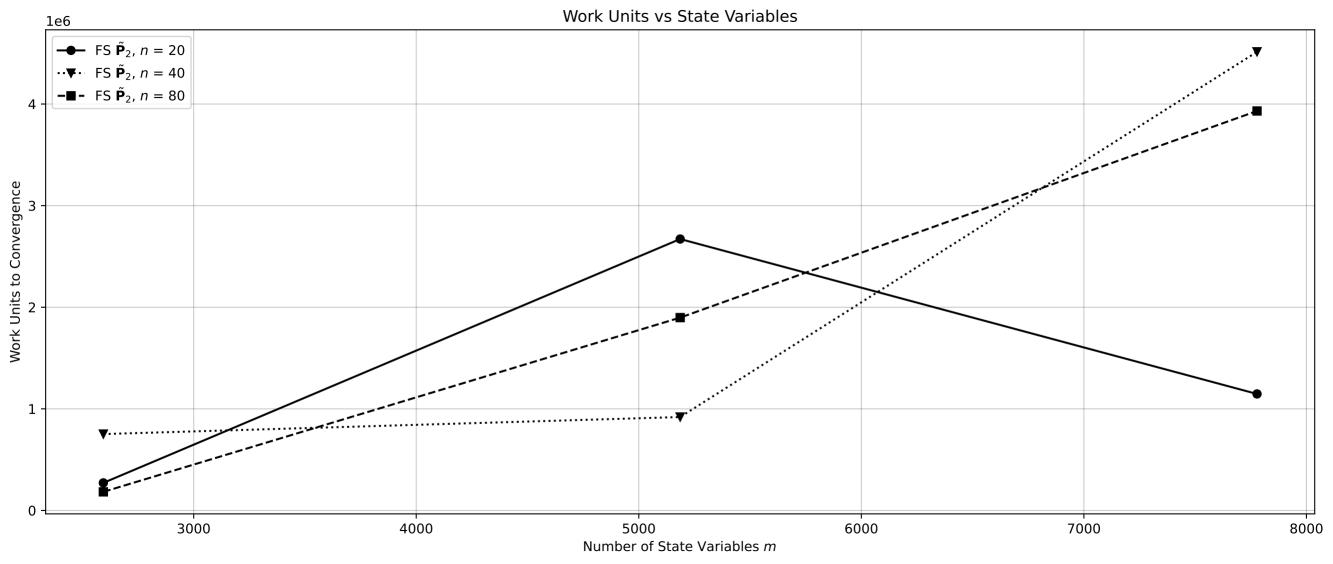












Gradient Norm vs Design Cycles m = 518610⁰ \rightarrow RS BFGS, n = 20 \rightarrow RS BFGS, n = 40RS BFGS, n = 80 10^{-1} --- FS $\tilde{\mathbf{P}}_2$, n = 20--- FS $\tilde{\mathbf{P}}_2$, n = 40--- FS $\tilde{\mathbf{P}}_2$, n = 80 10^{-2} Gradient Norm 10^{-5} 10^{-6} 10^{-7} 100 200 250 300 50 150 Design Cycles