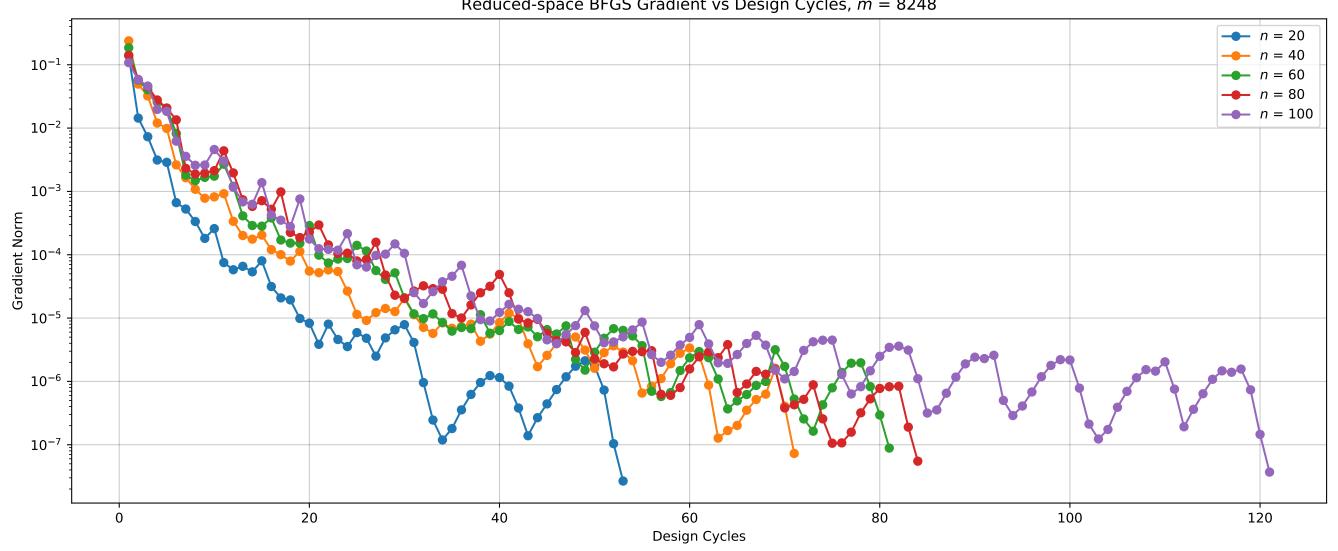
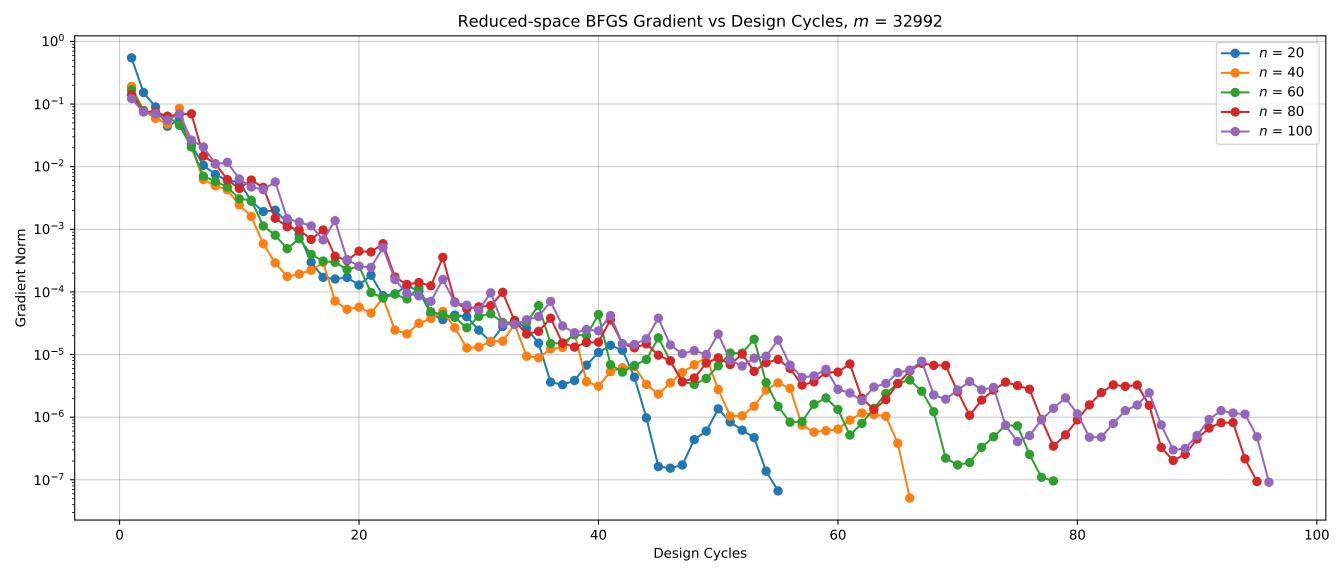
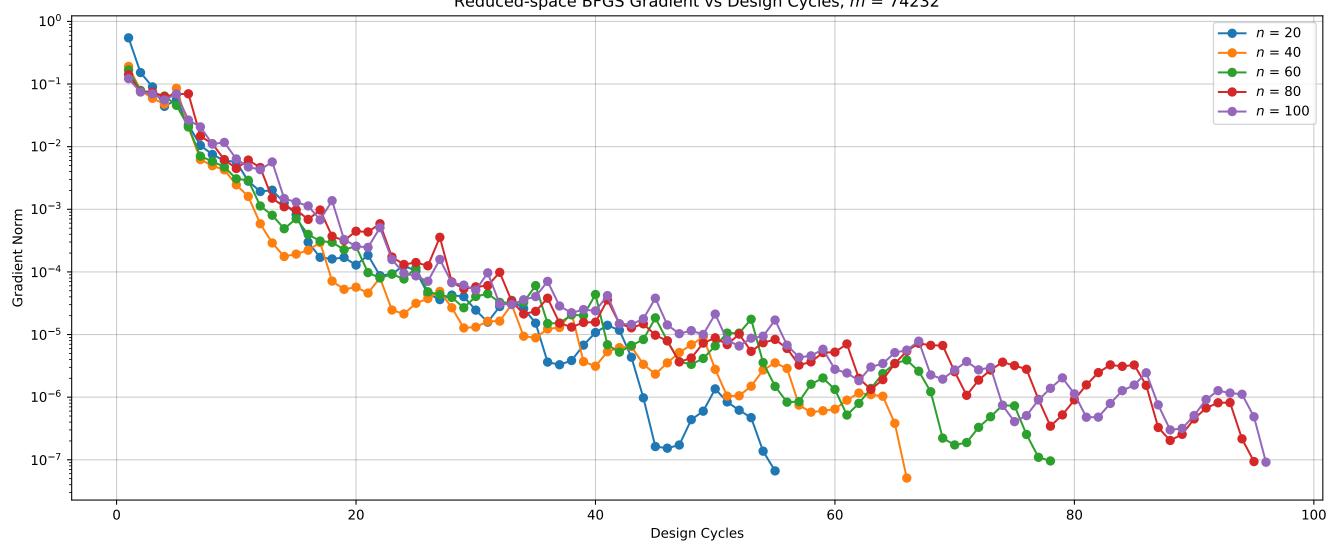
Reduced-space BFGS Gradient vs Design Cycles, m = 8248

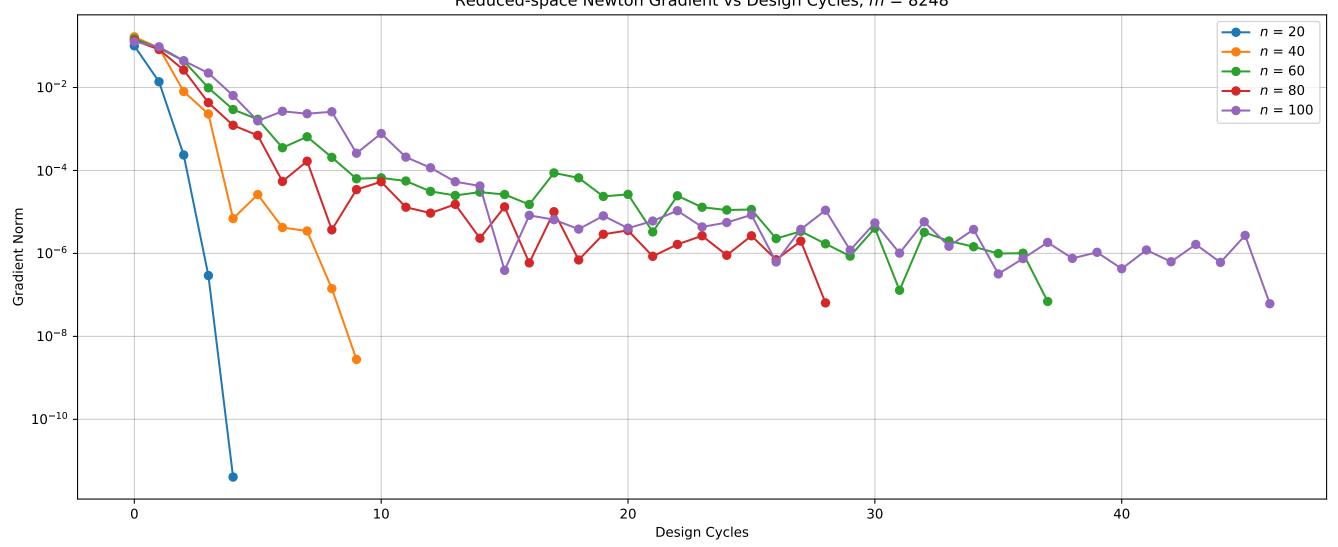




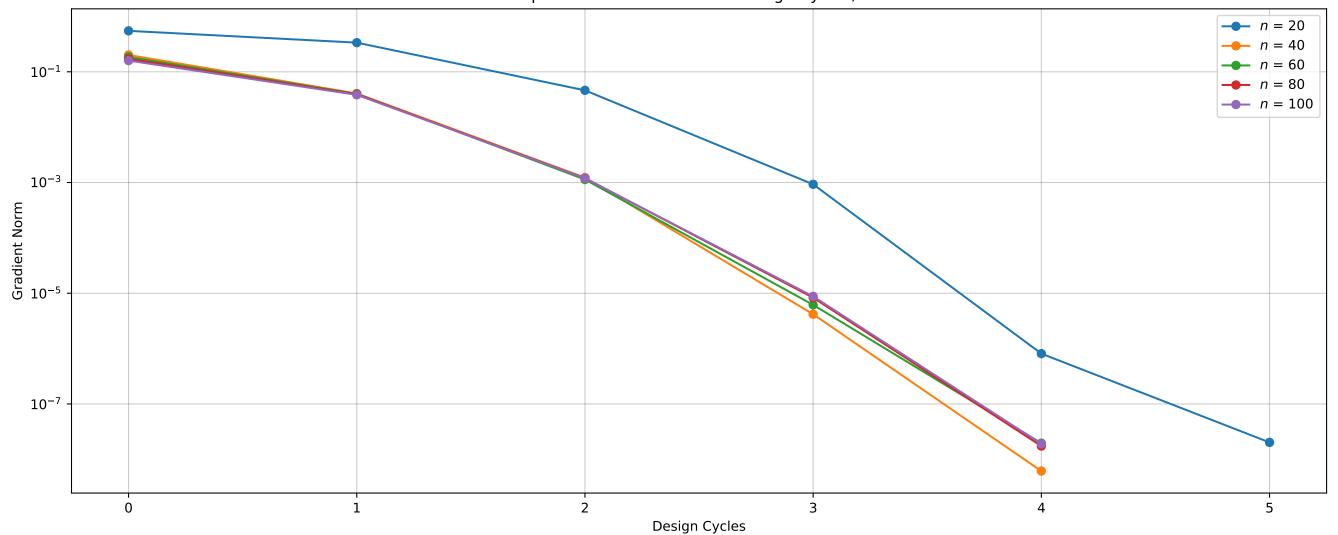
Reduced-space BFGS Gradient vs Design Cycles, m = 74232



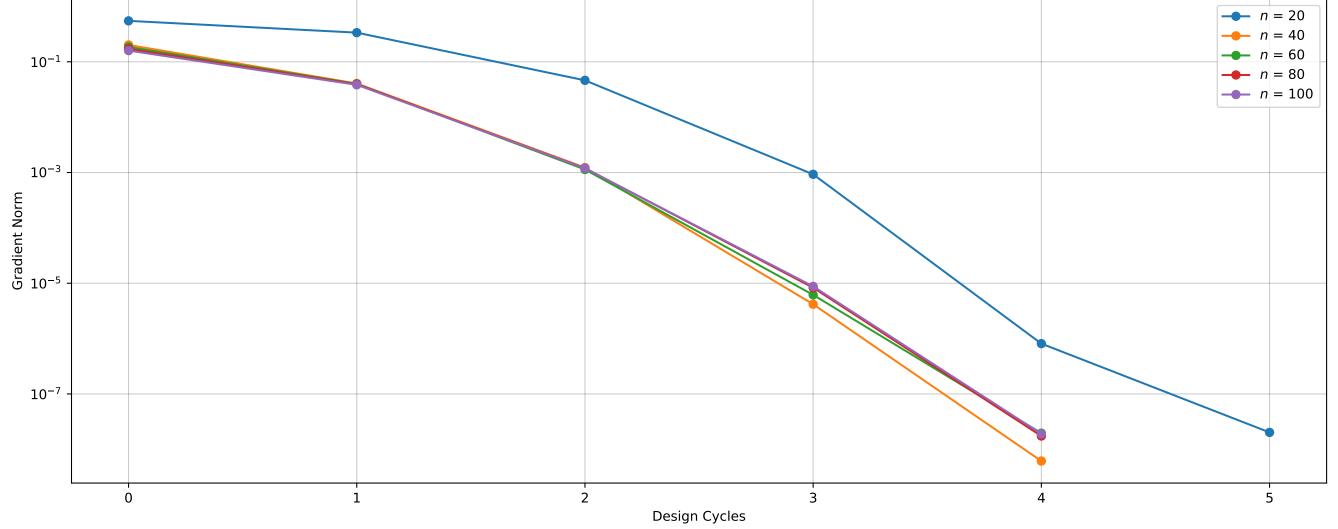
Reduced-space Newton Gradient vs Design Cycles, m = 8248



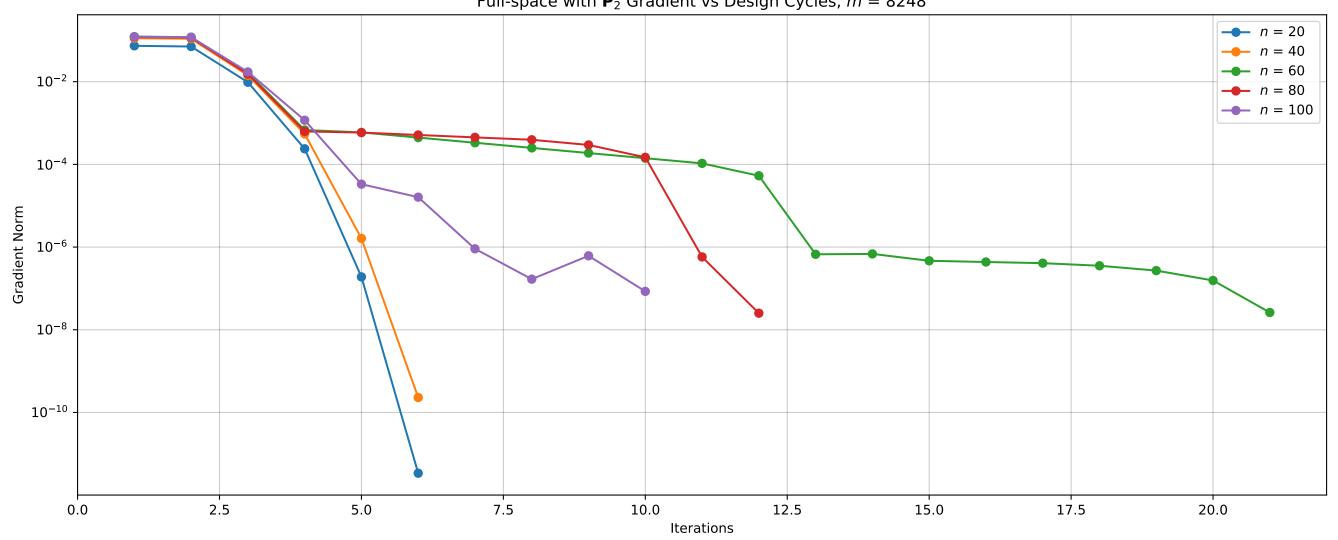
Reduced-space Newton Gradient vs Design Cycles, m = 32992--- n = 20-- n = 40--- n = 60--- n = 80--- n = 100



Reduced-space Newton Gradient vs Design Cycles, m = 74232



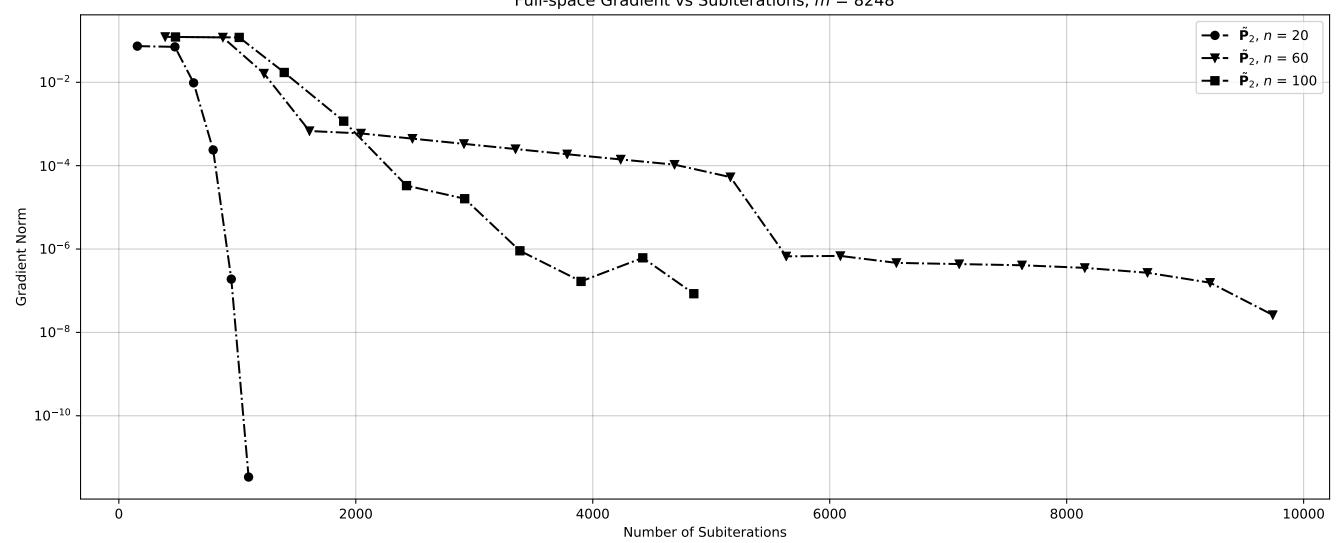
Full-space with  $\tilde{\mathbf{P}}_2$  Gradient vs Design Cycles, m=8248



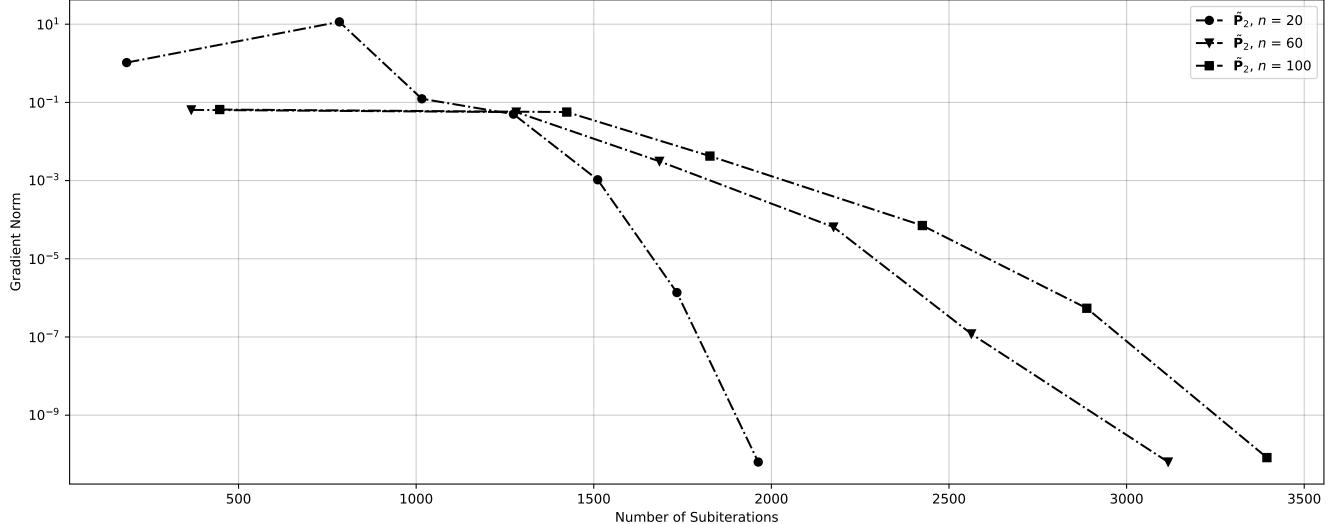
Full-space with  $\tilde{\mathbf{P}}_2$  Gradient vs Design Cycles, m=32992--- n = 20 $10^1$ --- n = 80--- n = 100 $10^{-1}$  -10-3 -Gradient Norm 10-7 10-9 Iterations

Full-space with  $\tilde{\mathbf{P}}_2$  Gradient vs Design Cycles, m=74232--- n = 20 $10^1$ --- n = 80--- n = 100 $10^{-1}$  -10-3 -Gradient Norm 10-7 10-9 Iterations

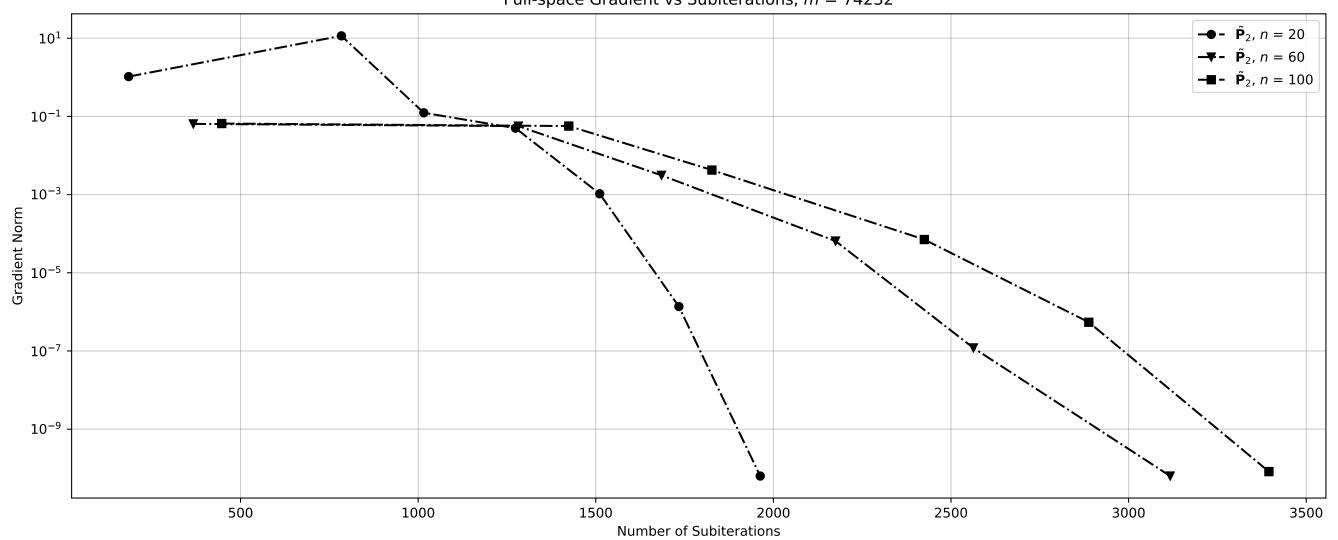
Full-space Gradient vs Subiterations, m = 8248

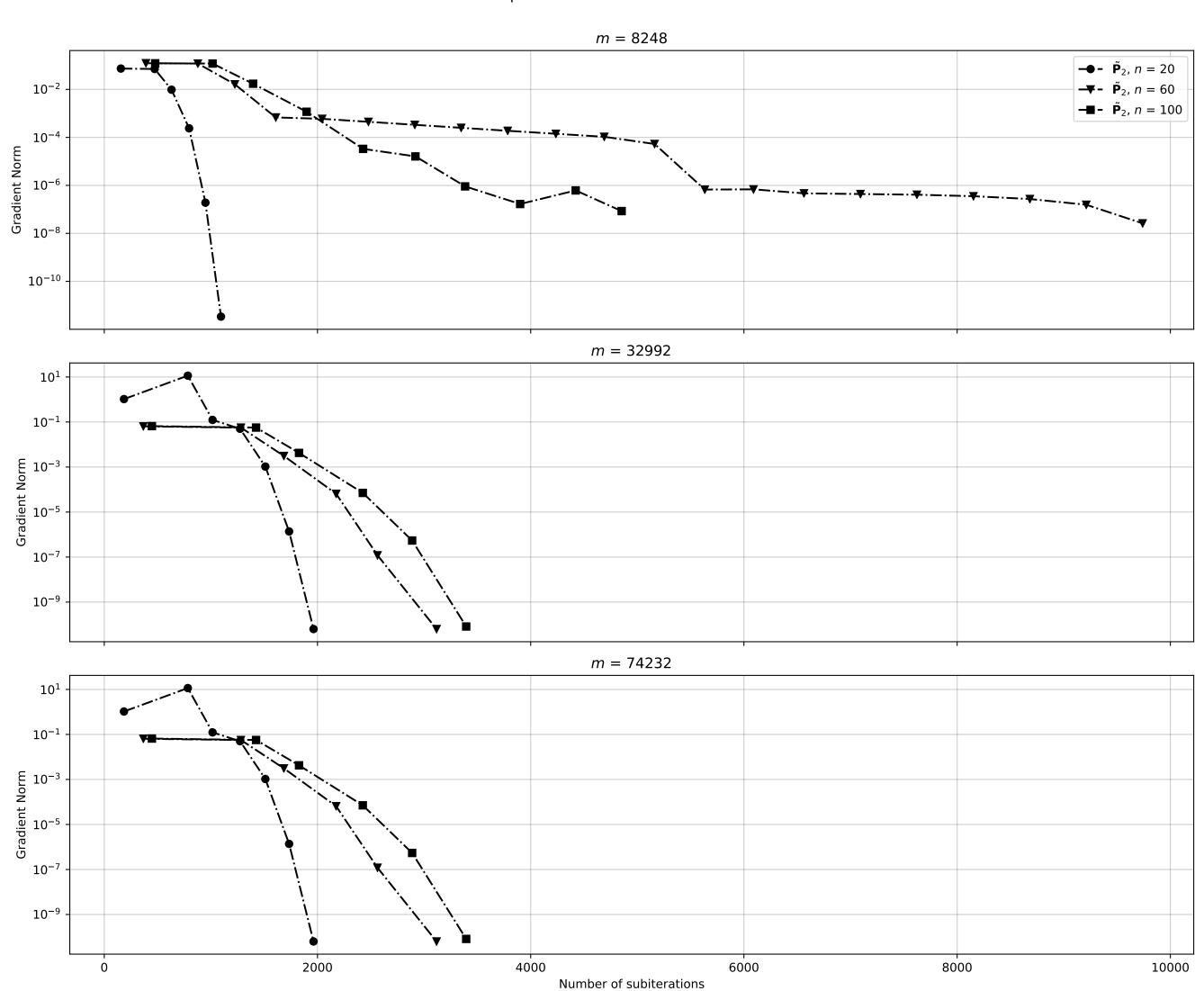


Full-space Gradient vs Subiterations, m = 32992**→** -  $\tilde{\mathbf{P}}_2$ , n = 20**-▼**-  $\tilde{\mathbf{P}}_2$ , n = 60**-■-**  $\tilde{\mathbf{P}}_2$ , n = 100

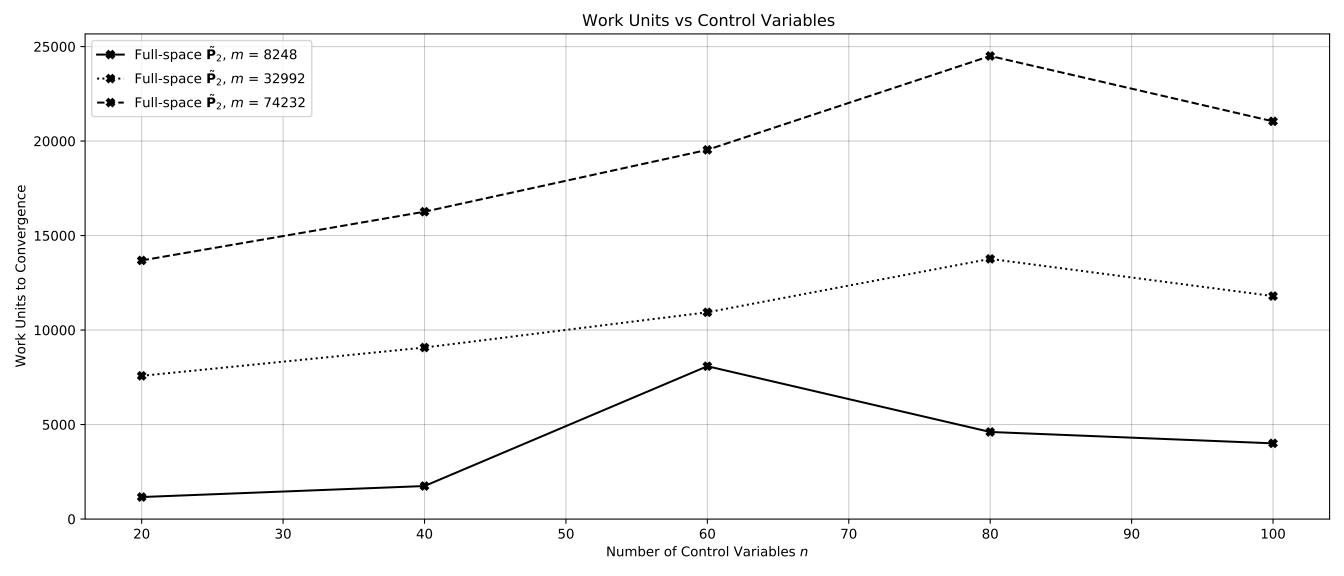


Full-space Gradient vs Subiterations, m = 74232

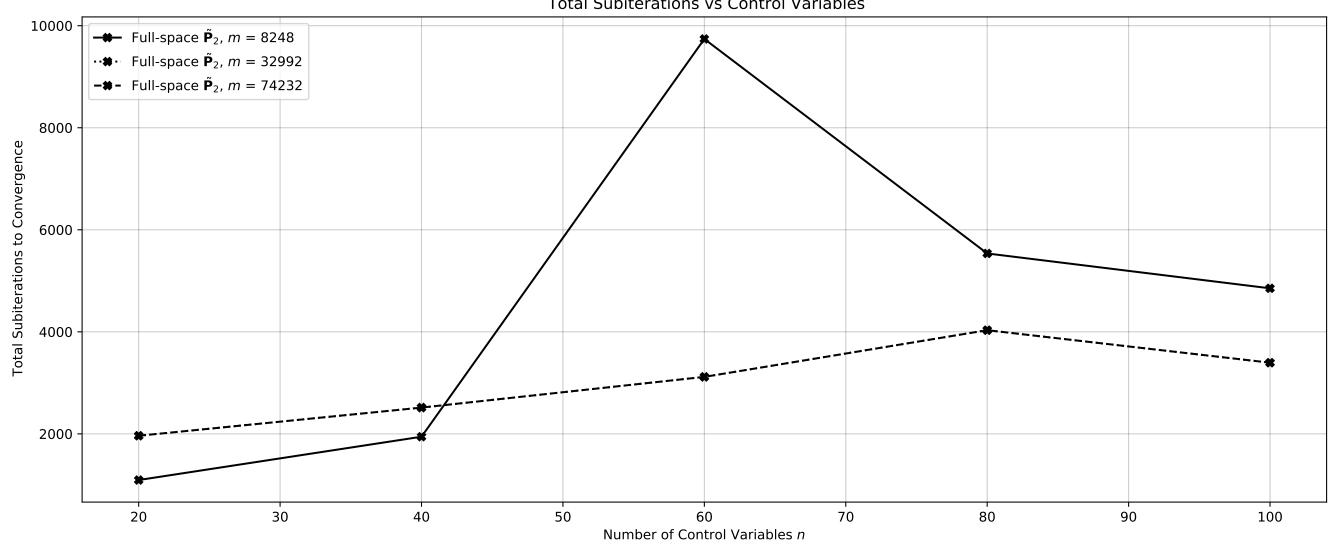


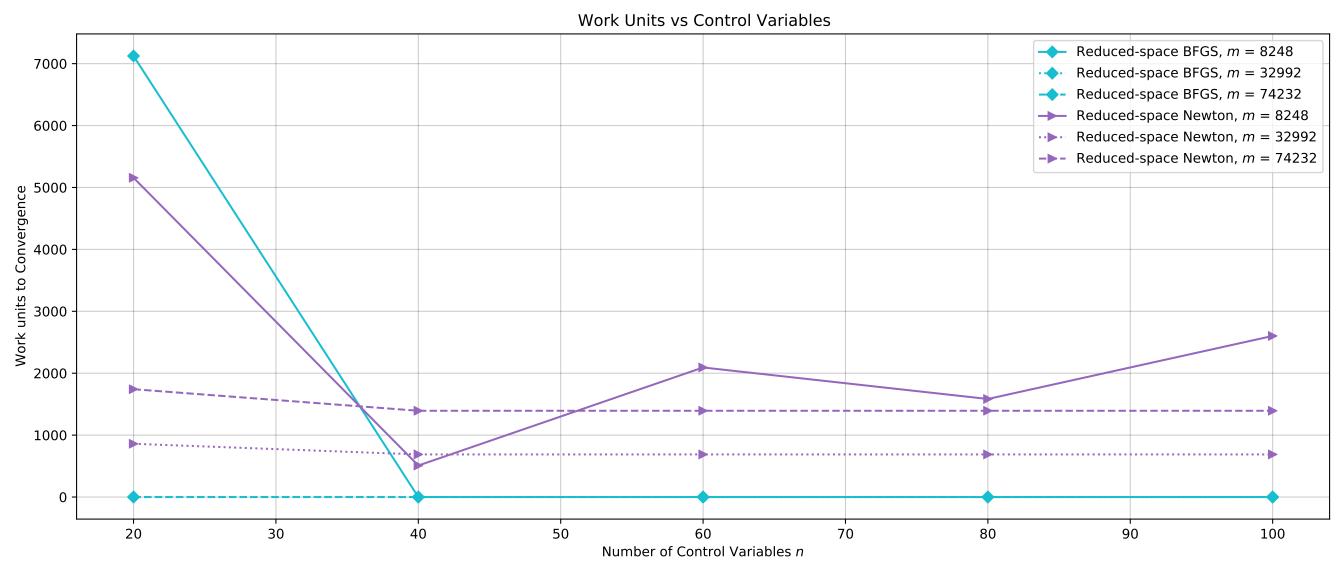


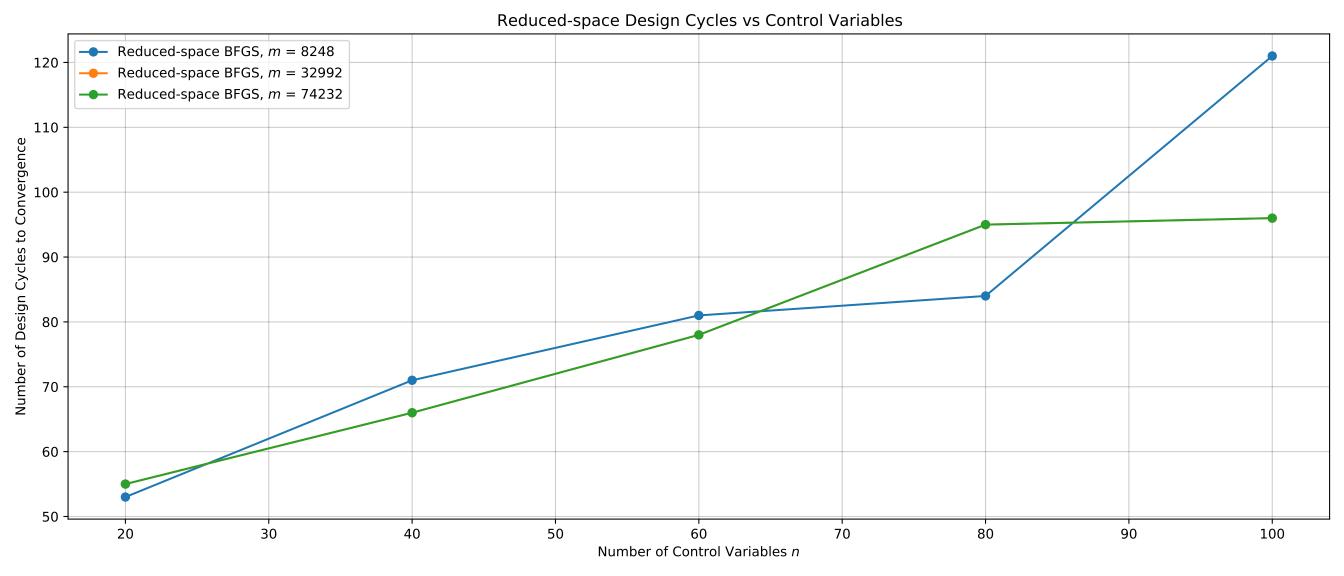
Full-space Design Cycles vs Control Variables  $\longrightarrow$  Full-space  $\tilde{\mathbf{P}}_2$ , m = 8248••• Full-space  $\tilde{\mathbf{P}}_2$ , m = 32992**-⇒ -** Full-space  $\tilde{\mathbf{P}}_2$ , m = 74232Number of Design Cycles to Convergence 70 80 30 40 50 60 90 100 Number of Control Variables n

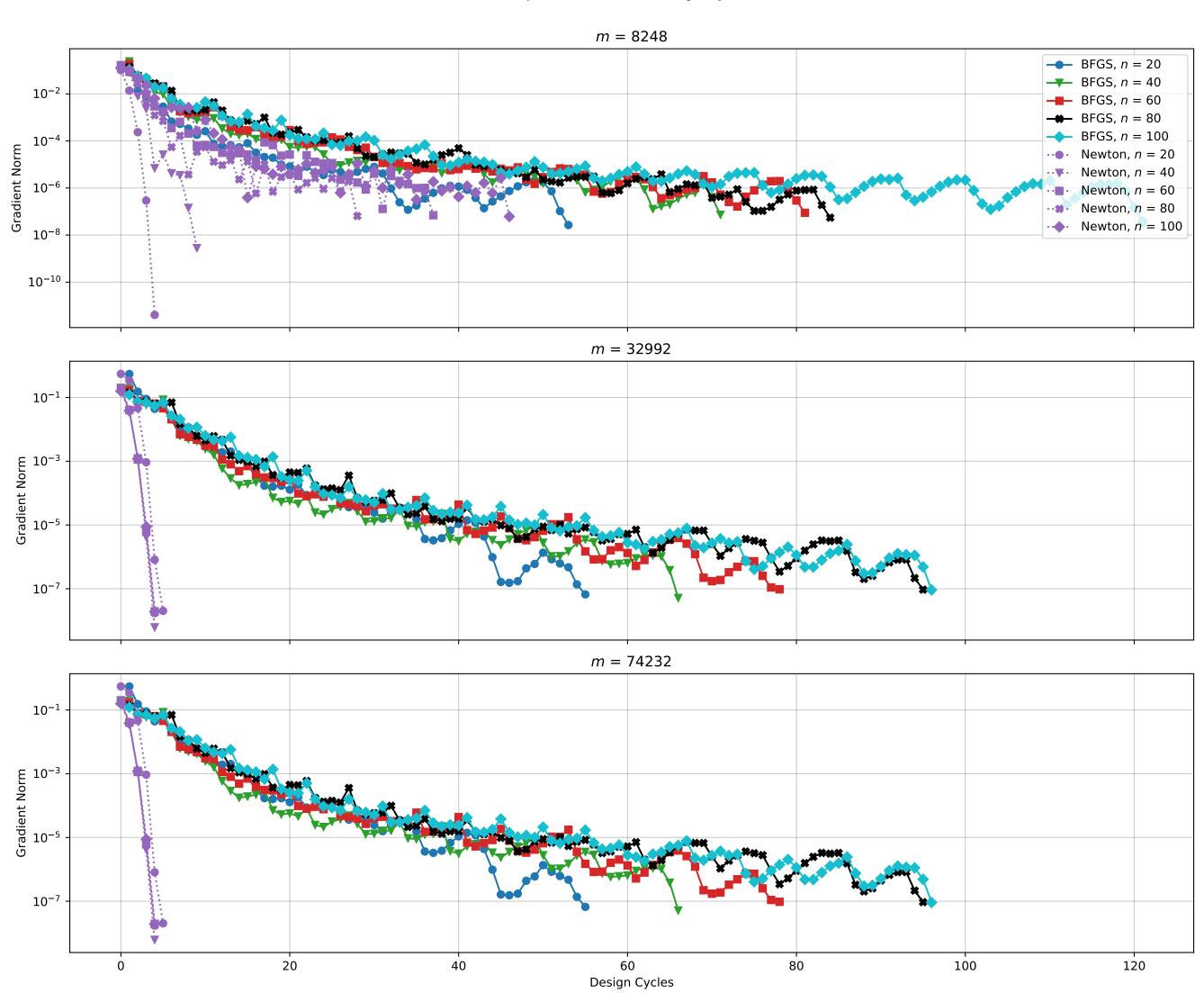


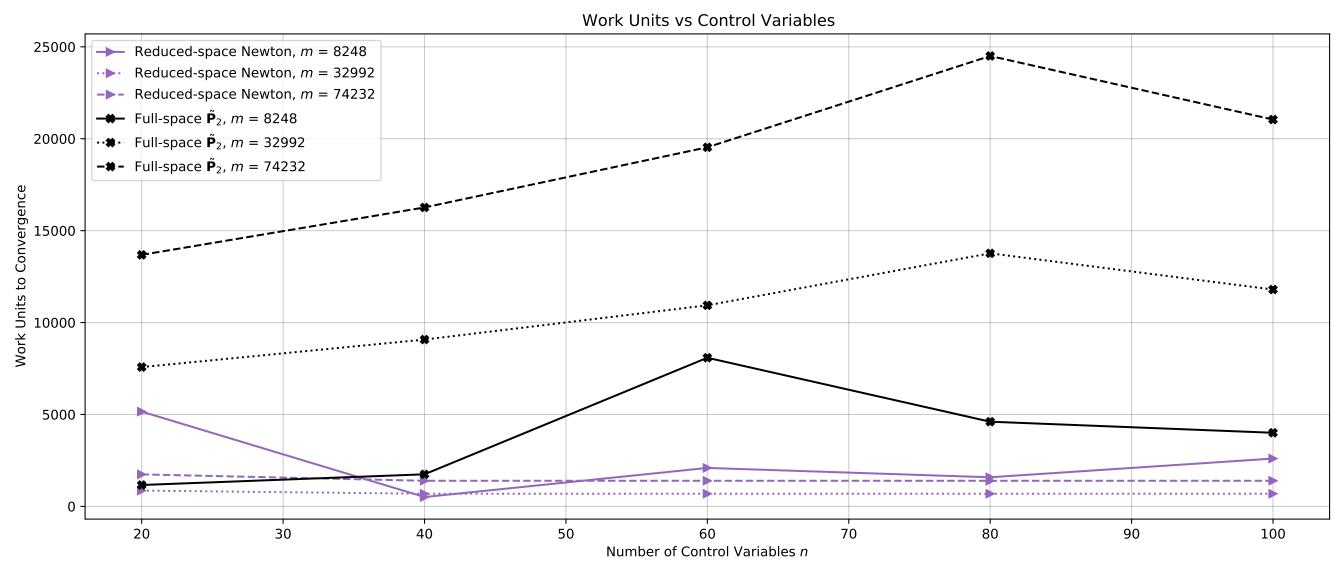
Total Subiterations vs Control Variables











Work Units vs State Variables

