Figure 1: Primary Control Layer Validation Results

A) Frequency Response to Load Step

Load Step (+20%)

Conventional Droop
Enhanced PINODE-Droop
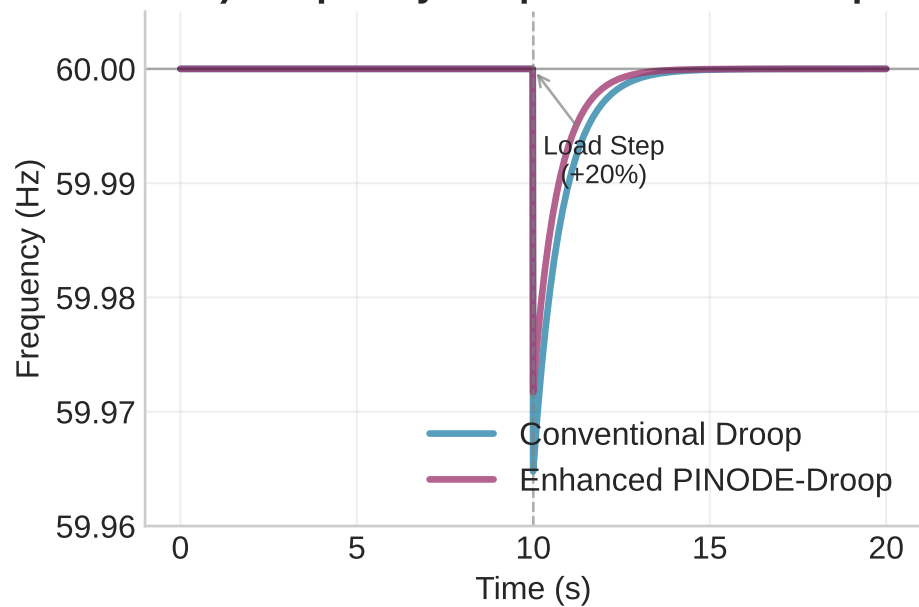
B) Rate of Change of Frequency

Conventional
Enhanced
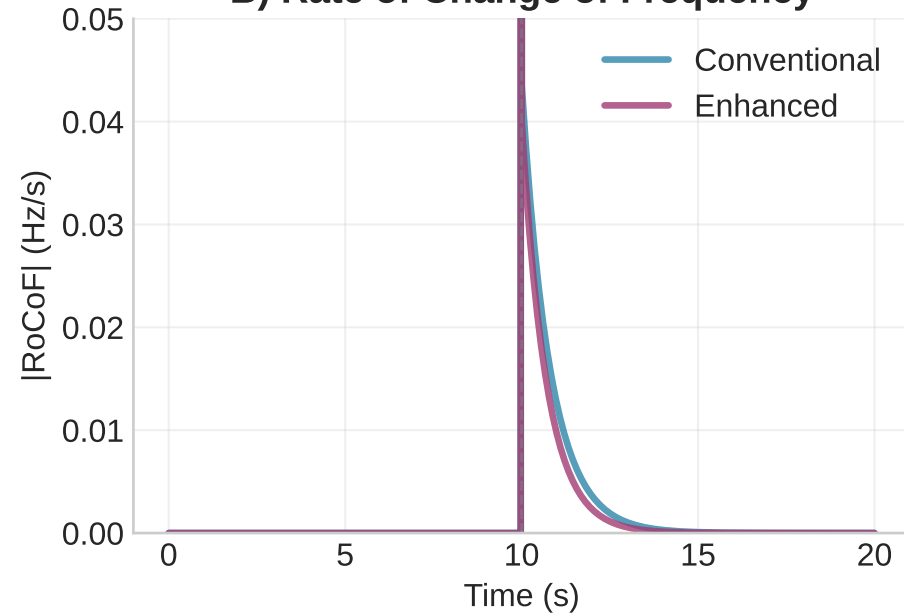
C) Primary Control Performance Comparison

19.8% improvement
19.8% improvement
19.8% improvement

Conventional Droop
Enhanced PINODE-Droop

Frequency Nadir (Hz)
Max RoCoF (Hz/s)
Final Error (Hz)

Performance Metrics