MICROGRID CONTROL

Introduction
- High penetration of renewable energy resources in the power grid
- Stability issues, frequency fluctuations, voltage control, protection system coordination
- System approach: microgrid
- Energy problems solved locally
- Grid connected operation
- Islanded operation: uninterruptable power supply

Microgrid control methods
- Centralized: optimal performance, high bandwidth communication, reliability issue
- Decentralized: Droop

Basic idea of the droop control
- Use f and E as linking signals to coordinate the DGs

Proposed solution
- Coordination of current instead of power

PROPOSED CONTROL METHOD
- DGs synchronized through a GPS signal
- Utilization of dq voltages as linking signals
- Coordinate dq currents instead of P and Q
- Compensate the transformer voltage drop to minimize voltage deviations
- Gain scheduled droop control law:

\[ E_{\omega} = E_{\omega}^0 + \left[ R_n - X_n \right] i_{\omega} - m_{g}(i_x) \, n_{g}(i_x) \]

- Behaves like a virtual resistor
- Increased system damping

BENCHMARK MICROGRID

SIMULATION RESULTS

Conventional Droop Method

Proposed Method

CONCLUSIONS
- The conventional droop control relies on large inertia of synchronous machines.
- A new droop control scheme in accordance with the characteristics of inverter-based DGs (low inertia and strict current limits) is proposed.
- Simulation results show a significant improvement in the DGs dynamic response.