**Introduction**

Transient Response

Three disturbance sources

- Output reference signal
- Input voltage
- Load current

Fast dynamic current slew rate presents challenge in load transient response of power supplies

**Research Objective**

**Proposed Control Scheme**

- Based on voltage-mode control
  - Not require current sensor
  - Not require slope compensation
  - \( V_{IN} \) and \( V_{OUT} \) regulate the slope
  - Line feed-forward control
  - Wider closed-loop band
- Simple
  - Not require complicated calculation

**Conventional Method**

- Feed-back control
  - Voltage-Mode Control
    - Without line feed-forward control
    - Limited bandwidth
  - Current-Mode Control
    - Slope compensation
    - Current sensor
- Feed-forward control
  - Complicated non-linear calculation
  - Not cost effective

**DC-DC Buck Converter with Slope Adjustable Triangular Wave Generator**

**System Configuration**

**Triangular Wave Generator Circuit**

\[
V_{TRI} = G_3 C \cdot \frac{v_g}{1 - V_{CON} \cdot t} = M \cdot \frac{V_g}{1 - V_{CON,MAX} \cdot t}
\]

**Duty Cycle Modulation**

\[
\Delta d = \Delta d_1 + \Delta d_2 = \frac{V_e + G_3 \Delta v}{v_p} - \frac{1}{m} \frac{G_3 \Delta v}{v_{SS}}
\]

**Stability Analysis**

- Bandwidth increase
  - 50kHz → 109kHz
- Phase margin decrease
  - 40° → 10°

TWG needs phase compensation

**Simulation Result**

**Line Transient Response**

\( v_g : 5V \leftrightarrow BV \)

**Load Transient Response**

\( i_{out} : 100mA \leftrightarrow 420mA \)

**Summary**

Design a slope adjustable triangular wave for DC-DC buck converter

- Dynamic performance improvement
- Simple
  - Not require current sensor
  - Not require slope compensation
  - Not require complicated calculation

**Reference**


