

ELECTRICAL AND ELECTRONICS ENGINEERING DEPARTMENT

EE464 POWER ELECTRONICS – II

Homework III

**Yunus Çay 2166148**

Table of Contents

**No table of contents entries found.**

# Plant Characteristics

## Examination of Transfer Function

Transfer function is mathemetical function that represent the relation between output and input theoretically. In other words, transfer function models the plant.

## Bode Plot of the Plant

Figure 1 shows the bode diagram for control-to-output transfer function of buck converter with and without ESR of the capacitor. Both system are similar up to a point where the zero is located due to the ESR of the capacitor. Since the ideal system doesn’t have zero, phase of ideal system continues to decrease and slope of gain decreases with -40dB. On the other hand, non-ideal system gain reduces with -20dB after the zero of the non-ideal plant.

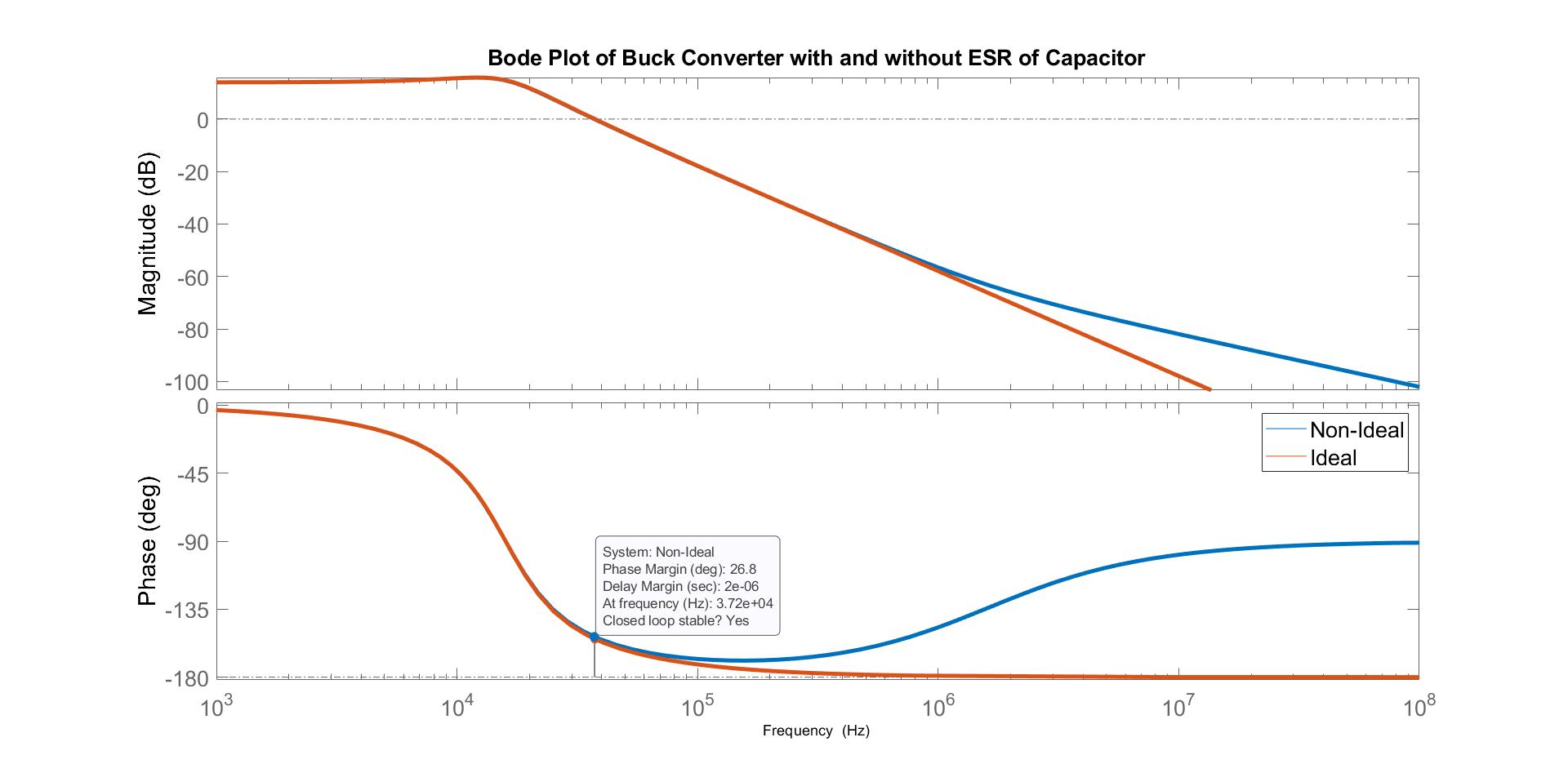


Figure 1 Bode diagram for control-to-output transfer function of buck converter with and without ESR of the capacitor

Theoretically, both ideal and non-ideal plant does not have gain margin since their phases does not reach -180°. Ideal system, however, is very close to the -180° so that gain margin of ideal plant can be calculate at 106 Hz as 58.2 dB. On the other hand, their phase margins are calculated at 37.2 kHz which is also named crossover frequency. The phase margins are 25.3° and 26.8° for ideal and non-ideal plants, respectively. That the difference in phase margins is small is because zero of the non-ideal plant is far away from the cross-over frequency.

# Controller Design

## Identification of Poles and Zeros