Abstract

For Master's Certification

on the topic:

"Investigation of the curvature-corrected techniques for the bandgap voltage references"

By Andrey A. Kostiuchenko

The Relevance

Precision bangap voltage references are always in great demand in many applications such as analog to digital and digital to analog converters, voltage regulators and measurement systems. As a resolution of data converters system increases, requirements for very high temperature stability of BVR have also increased. This has given a rise to many temperature compensation techniques such as quadratic temperature compensation, exponential temperature compensation and piecewise line temperature correction. This considerably complicates the selection of the most effective solution.

The Purpose

The purpose of this diploma is analysis of up-to-date curvature correction techniques for bangap voltage reference and the existing schematic decisions and investigation of possibility curvature-corrected bandgap voltage reference realizations on the submicron design rule.

Problems that are solved

To achieve this goal in this paper the following problems were solved:

- Analysis of up-to-date high-precision high-order curvature correction techniques for bangap voltage references;
- Analysis of the most promising schematic decisions, presented in the scientific references;

- The investigation of possibility curvature-corrected bandgap voltage reference realizations on the submicron design rule;
- Analysis and comparison of the circuits simulation results.

Results Achieved:

The author defends:

- Recommendations for choosing the most efficient schematic decision for the design on submicron design rule.
- The results of comparison of temperature characteristics for the investigated curvature-correction bandgap voltage references.
- The results of simulation of the circuit with temperature coefficient 11 ppm/°C with the minimum supply voltage 0.9 V output voltage 0.539 V.

Scientific novelty

Scientific novelty of the work is the formation of recommendations for curvature-corrected bandgap voltage reference design at submicron design rule in order to obtain the lowest output voltage depending on temperature and supply voltage.

The practical value

The practical value of the work is in systematization of the recommendations for the design of temperature stable voltage reference and executed calculations.

Conclusion

As a result of research:

1. Analysis of more than 20 scientific sources up to 2010 year in the field of curvature-correction techniques has been conducted.
2. The design trend and current design methodologies of curvature-corrected bandgap voltage reference were analyzed. The focus is mainly on the low-voltage and low-tempco designs, which is the vital requirements of future IC systems.
3. The comparison of performance of most promising design decisions was done.
4. The simulation results for the most promising decisions of curvature-corrected bandgap voltage reference were done. The obtained results were explained.
5. Possible problems and mismatches in designing curvature-correction bandgap voltage were pointed.
6. Recommendations for the most perspective trend in curvature-correction technique were given.

The work contains: pages 74, pictures 42, tables 1, sources 21.

Key Words: VOLTAGE REFRENCE, BANDGAP VOLTAGE REFERNCE, CURVATURE CORRECTION TECHNIQUE, TEMPERATURE COEFFICIENT.