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Tolerance analysis of SEPIC converter

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GOAL OF THE STUDY

The paper presents tolerance analysis of SEPIC DC-DC converter. Based on a verified model, the influence of the accuracy of the magnetic components and the capacitors on the output indicators of the selected power electronic device is determined.

METHODOLOGY OF THE INVESTIGATION

In the study, the variation of the values of the elements was chosen to be performed in pairs, and due to the peculiarities of the power scheme the change of the inductors L1 and L2 is performed jointly, although a variant without magnetic coupling between them was chosen.

MAIN RESULTS FROM THE STUDY

Accurate quantitative assessment of this impact on the operating mode is presented in tabular form and through 3D graphs. In this way, the optimal selection of circuit elements is made at the design stage. The presented results are also useful for studying the stability and synthesis of optimal control of SEPIC DC/DC converter.

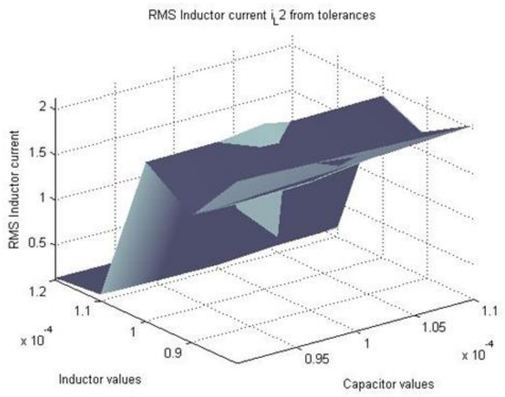

Fig. 1. Variations of the RMS value of the current through the inductor L2 (i_{L2}) when changing the values of C1 and inductances L1 and L2

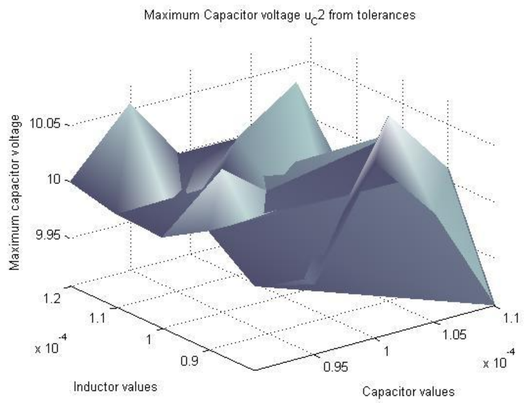

Fig. 2. Variations of the amplitudes of the output voltage (u_{C2}) when changing the values of C1 and inductances L1 and L2

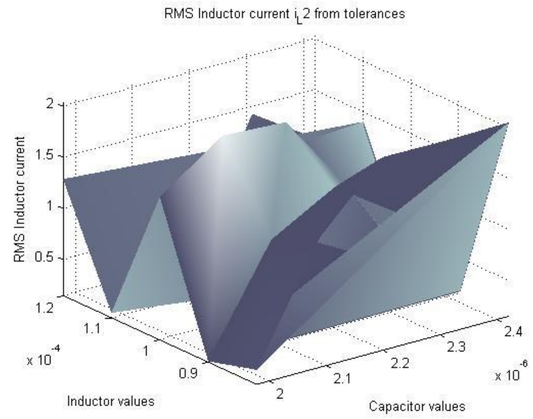

Fig. 3. Variations of the RMS value of the current through the inductor L2 (i_{L2}) when changing the values of C2 and inductances L1 and L2

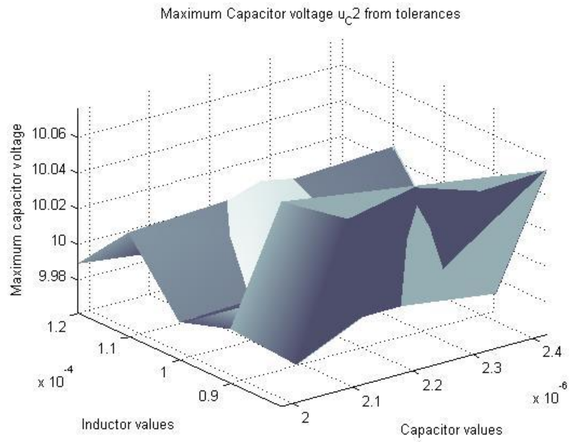

Fig. 4. Variations of the amplitudes of the output voltage (u_{C2}) when changing the values of C2 and inductances L1 and L2

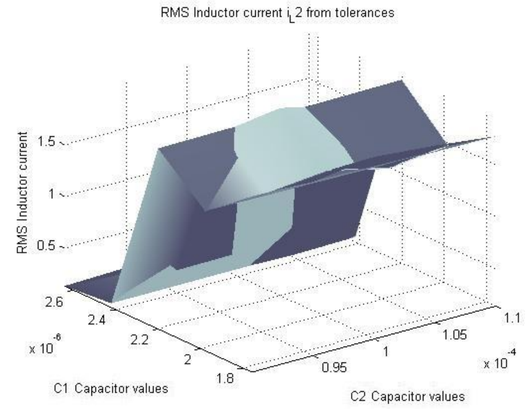

Fig. 5. Variations of the RMS value of the current through the inductor L2 (i_{L2}) when changing the values of capacitors C1 and C2.

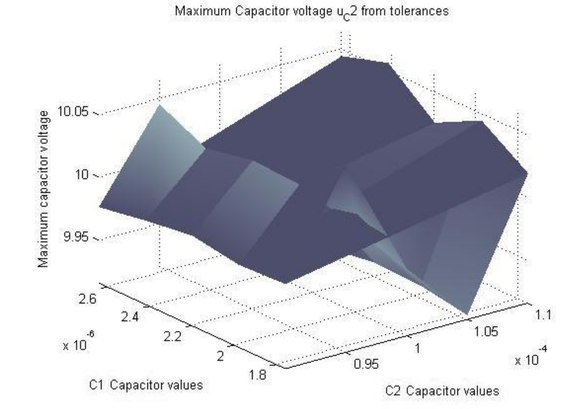

Fig. 6. Variations of the amplitudes of the output voltage (u_{C2}) when changing the values of capacitors C1 and C2

CONCLUSIONS

In all cases the change of the values of the circuit elements leads to significant variations of the current through the inductive elements, while at the output voltage the changes are within 1% of its nominal value; The combination of C1, L1 and L2 tolerance analysis has the most significant effect on the inductor current iL2, and the least effects on C1 and C2, that influence iL2; At the output voltage the variations are very close, but here too the effect of the combination C1, L1 and L2 is the greatest, and at least at C2, L1 and L2;

The operating mode is most sensitive to the tolerance of the inductive elements and therefore in their design and selection measures must be taken to ensure the stability of their parameters.

ACKNOWLEDGMENT

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