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Control of a Single-phase Inverter by an Integrated Current Mode Pulse Stabiliser

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ABSTRACT

A system for current mode control of an inverter for energy injection in the grid from renewable sources is developed. In this system an integrated pulse controller, operating in the same mode is used and adapted to the bipolar operation. For this purpose, a double phase control signal is created and connected to a resistive divider which is connected also to the inner stabilized source of the integrated circuit. A model circuit and the mould results are given.

Keywords: inverter, current mode control, renewable sources.

INTRODUCTION

The current mode control has a broad putting into practice of the pulse power supplies because of the high stability and security against current jumps, caused breakdown of the power switches. In these applications the control is unidirectional and realizes a stabilization of the output signal.

For control of inverters of current into the electric grid the problem is more complicated. The current is bipolar and with sinusoidal form. This causes a necessity of adaptation of the unidirectional integrated pulse controller to the bipolar control voltage of the servo system for the output current.

PRINCIPAL SOLUTION

This solution is shown in Fig. 1. The used IC is UC3843, or a similar one [1]. The output

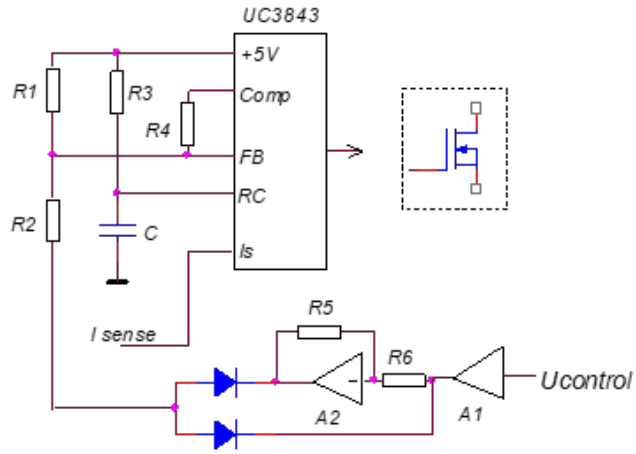

Fig. 1. Principle of the usage of integrated current mode pulse stabilizer UC3843 for inverter control.

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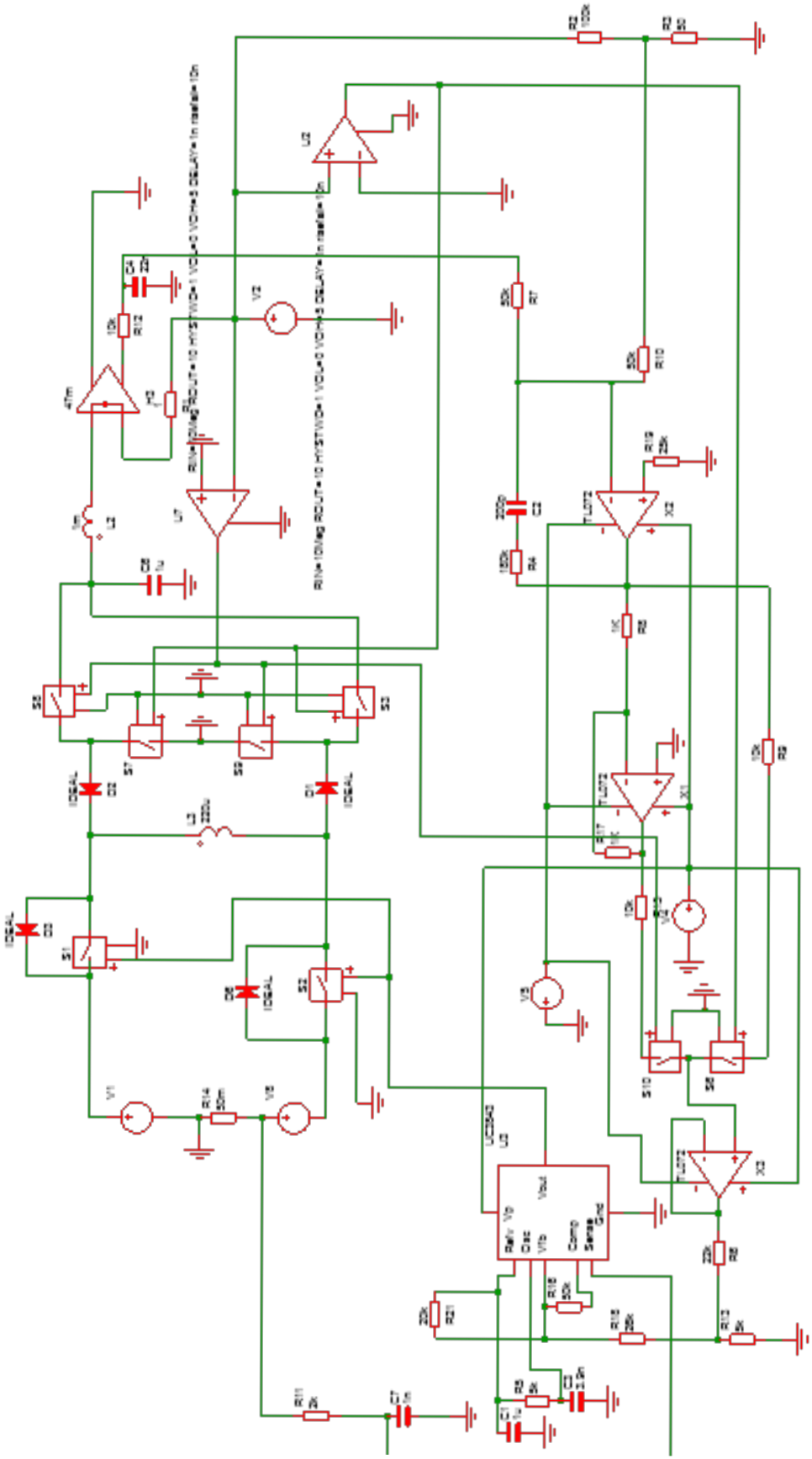

Fig. 2. Real modeling circuit with Simplis/Simetrix.

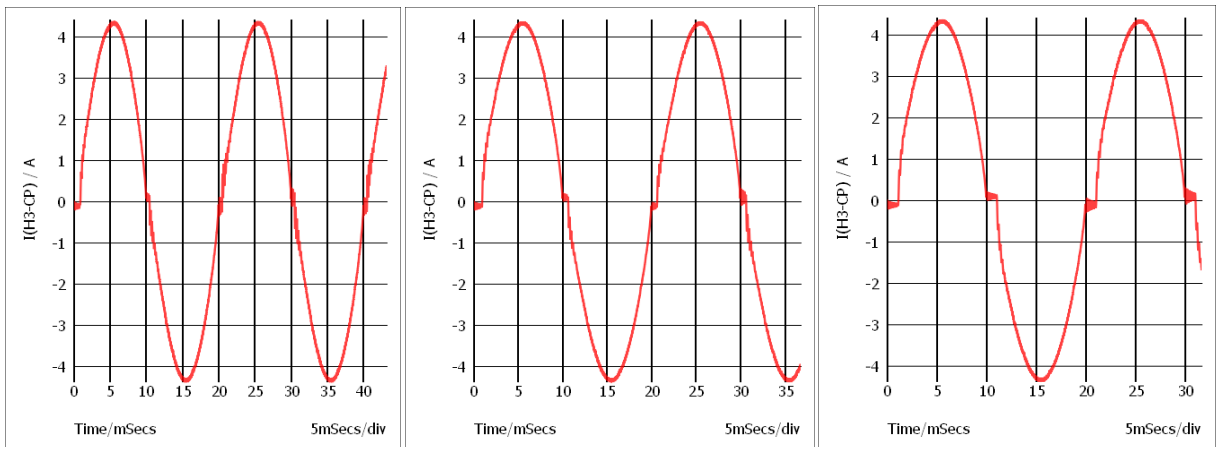

Fig. 3. Output current, injected in the electric grid at different values of the resistors of the divider R1 - R2 (R18 - R21 in Fig. 2.): (a) an efficient result; (b) and (c) - at non-correct choice of the divider.

control voltage is transformed into a two phase one via both operational amplifiers A1 and A2.

The output diodes transform both phases into a pulse voltage with approximately sinusoidal form. The resistor divider R1 - R2 is connected with its first terminal to the inner stabilized source +5V. The other terminal is connected to the mentioned pulse voltage, the middle point - to the Feed Back input of the integrated circuit. Because this input is inverted against the output signal, the diodes are connected with direction to invert a second time the control signal.

The group R3-C determines the switch frequency, the resistor R4 is connected as feedback of the inner amplifier and set its gain. The true choice of the values of R1 and R2 is important for the absence of transient disturbances at transition of the output current across the zero value.

MODELING OF THE CIRCUIT WITH Simplis/Simetrix

On Fig. 2 is presented the real modeling circuit, assembled according to the Symmetric topology with flying inductor, presented in [2, 3]. Instead of the diodes from Fig. 1, two ideal switches S6 and S10, controlled from the polarity of the output signal are placed.

The "set" signal is a sinusoidal voltage, received from the "grid voltage V2" by the divider R2 - R3. The grid voltage V2 is 240V with amplitude value 340 V. The feedback from the output current is through the current sensor H3, the feedback from the primary current is realized as a voltage drop on the resistor R14.

On Fig. 3 (a, b, c) is given the output current, injected in the grid, at different values of the divider R1 - R2 from Fig. 1, respectively R18 - R21 from Fig. 2. The good result (a) is at correct divider, and results with non-correct divider in - (b, c).

CONCLUSIONS

The current mode control of inverters, transformerless connected to the electric grid, has all advantages of the current mode control of the pulse stabilized power supplies. It is possible the use of this mode by the assistance of a broad popular integrated controller. To adapt this controller to the bipolar operation of the inverter, a simple design is proposed.

Another advantage of the current mode control of inverters is the more steady behavior, especially at unbroken operating mode, which is mold with the circuit from Fig. 2 and shown in Fig. 3.

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