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A CONTROL SYSTEM TO MINIMIZE THE DYNAMIC POWER LOSS IN AN UNBALANCED VOLTAGE REGULATOR MODULE AND ITS METHOD OF OPERATION

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ABSTRACT

An unbalanced mode voltage regulator module (VRM) based switching power converter adapted to reduce dynamic power loss, increasing efficiency, fast transient response and improved power density for output load. The VRM maintains precise output voltage within specified threshold limits, particularly during the transient high slew-rate load transients. A VRM based DC-DC conversion system is disclosed wherein a main converter running in parallel with an auxiliary converter incorporating a hysteretic constant turn-off controller and an additional lead-lag compensator, minimizing dynamic power loss in extra dynamic channel of VRM and its control under selective load current transients to achieve decrease in settling time of output voltage and increase in overall energy efficiency. The output voltage undershoot and overshoot decreases by 59% and 63% respectively during 80% of full-load transient and the energy efficiency increases by 7% at 24A load transient and at 10 kHz load transient frequency. The control scheme for the VRM favour wide industrial application for a number of applications including the mobile, microprocessors, semiconductor industries etc.

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CLAIM 1

A voltage regulator module/system, comprising (a) a main converter adapted to provide regulated output voltage in steady state condition; (b) an extra dynamic channel (auxiliary buck converter) adapted to be activated in accordance with load transient; (c) a current sensor for sensing output current of the main converter; (d) a current sensor for sensing output current of the auxiliary buck converter and (e) a control circuit comprising a linear control circuit and a non-linear control circuit adapted to operate such as to maintain desired characteristics at the converter output by settling output voltage more quickly and selectively activating the auxiliary buck converter in accordance with the load transient associated with a decrease/increase in output voltage beyond voltage references decreasing duration of the auxiliary buck converter in operation during transients to improve efficiency.