Design and Implementation of a High Efficiency Multiple Output Charger based on the Time Division Multiple Control Technique

Introduction:

One of the more promising applications of MOCs would be multiple battery chargers due to its advantages in terms of cost, volume, efficiency and space for installation.

However, most of the conventional MOCs are not able to regulate all of the outputs accurately and independently without the help of complex hardware and controllers, which makes them unable to satisfy the strict ripple specifications of charge applications. In order to overcome the above mentioned disadvantages, several methods have been suggested. One method is to apply pre and post regulators to control the multiple outputs. However, accurate control in each slave output can barely be achieved since it is difficult to exactly match the magnetic coupling at each output. Furthermore, this makes it difficult to analyze the circuit. As a result, the design of the controller becomes difficult due to the complicated regulation between the outputs.
Existing system:

A controlled current source in the form of a fairly big inductor connected to each output through a switch on a time shared basis during one switching cycle. However, since it requires a large inductor as a current source, the converter becomes bulky and expensive. In addition, the method is extremely difficult to implement and complex in terms of small signal modeling on account of the differences in time sharing at each output during the freewheeling period of the inductor current. As a result, cross regulation problem is an inherent disadvantage of this method.

Drawbacks:

- A large inductor as a current source.
- Bulky.
- Expensive.

Proposed system:

The proposed converter can be used for the higher power applications since it has been developed based on the full bridge topology and exhibit a high efficiency. The proposed multiple battery charger is able to charge a number of batteries at different state of charges (SOCs) by using constant current and constant voltage (CC/CV) charge modes, which is considered to be an efficient method to charge batteries. Since the TDMC method can control each output independently, the battery at each output can be charged independently.
by either the CC mode or the CV mode. As a result, three batteries can be charged simultaneously. In addition, it is possible to satisfy the strict ripple specifications of the batteries since the cross regulation problem between the outputs does not exist.

Advantages:

- It offers an even degree of tight and independent regulation for each output, which is essential for multiple output charge applications.
- It is simple in design and analysis, and easy to model the circuit.
- No cross regulation problem exists among the outputs.
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- Only one secondary winding of the transformer is required to regulate the multiple outputs if no isolation between the outputs is required.
- Zero voltage switching (ZVS) turn-on can be achieved at all primary switches during the entire charge process.
- Zero current switching (ZCS) turn-on and ZVS turn-off can be achieved at all the secondary switches with no additional circuit.

Applications:
- Switching mode power supplies (SMPSs) of personal computers.
- Portable electronics.
- Household equipment.
- Multiple voltage power supplies.
- Telecommunication systems.

Block diagram: