Zero-Ripple Input-Current High-Step-Up
Boost–SEPIC DC–DC Converter with Reduced Switch-Voltage Stress

Introduction:
An environmental pollution is one of the greatest problems caused by the use of fossil fuels which is Emitting several billion tons of co2 per year. To reduce the production of co2, the renewable energy sources, such as photovoltaic, wind turbine, waves, and geothermal, are adopted in various industry applications. Also, fuel cells, batteries, and ultra capacitor are utilized as a power source for an electric vehicle.

However, these power sources have a very low-voltage value so that the high-step-up dc–dc converter should be needed to operate a load that requires high operating voltage. Moreover, lifetimes of these power sources are significantly reduced by the large current ripple. Hence, an input current ripple of the dc–dc converter should be removed. Generally, to reduce an input current ripple, a large input inductor can simply be used, but this method increases the size and weight of the converter.

Existing system:
For step-up applications, a conventional boost dc–dc converter is normally adopted. However, its voltage gain is not enough for high-step-up applications. To obtain high-voltage gain, many solutions have been studied. As the simplest methods, the boost converter can
be cascaded or stacked up on the other step-up converter. However, the cascade structure requires a lot of components as numerous as the count of the stages, which brings on low efficiency, complex circuit, and high cost.

Therefore, it is commonly integrated as a single-switch converter by sharing the main switch in order to reduce component count and circuit complexity. However, the conduction loss and switching loss is increased because each stage of the inductor current flows in one common switch. Hence, the sort switching is needed to improve the power efficiency. There are several high-step-up stacked boost converters. The stacked-up structure is generally that both dc–dc converters are connected up in parallel by the coupled inductor to obtain high-voltage gain. Since the output capacitor is connected in series, the voltage balance of the output capacitors should be considered.

Dis-Advantages:
- Conduction loss and switching loss is increased.
- More component count and circuit complexity.

Proposed system:
A zero-ripple input-current high-step-up boost–single ended primary inductor converter (SEPIC) dc–dc converter with reduced switch-voltage stress is proposed. Therefore, in order to reduce the complexity of the circuit, the proposed converter is based on a cascade boost–SEPIC converter with a single switch. Additionally, the input current ripple is removed at the boost stage by utilizing a ripple-free circuit composed of an auxiliary LC circuit and a coupled inductor.
To improve the power efficiency, the switch-voltage stress is reduced by the clamping circuit in the SEPIC stage so that the low-voltage rating MOSFET which has low $R_{ds(on)}$ can be utilized as a Main switch. Therefore, the conduction loss and switching loss of the main switch is reduced. In addition, the voltage gain is further increased by using turn ratio of a coupled inductor, and the reverse-recovery problem of the output diode is alleviated by the leakage inductor. Therefore, the proposed converter is suitable for fuel cell or renewable energy system.

**Advantages:**

- The conduction loss and switching loss of the main switch is reduced.
- The voltage gain is further increased by using turn ratio of a coupled inductor.

**Applications:**

- Fuel cell applications.
- Renewable energy system.
Block Diagram:

1. **DC input** → **High stepup boost sepic DC-DC converter** → **Load**
2. **12VDC** → **Gate driver circuit**
3. **5VDC** → **Buffer circuit** → **Microcontroller circuit**