MULTILEVEL INVERTER BASED ON SWITCHED-CAPACITANCE STRUCTURE

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Introduction

- Problems in multilevel inverters (MIs) employing current topologies used were identified:-
  - Large number of components(switches, power supplies, capacitors, and diodes)
  - Large size and high cost
  - Complex control
- Solution to the problem was a new MI topology that uses a Switched Capacitor(SC) structure in cascade with an H-bridge.

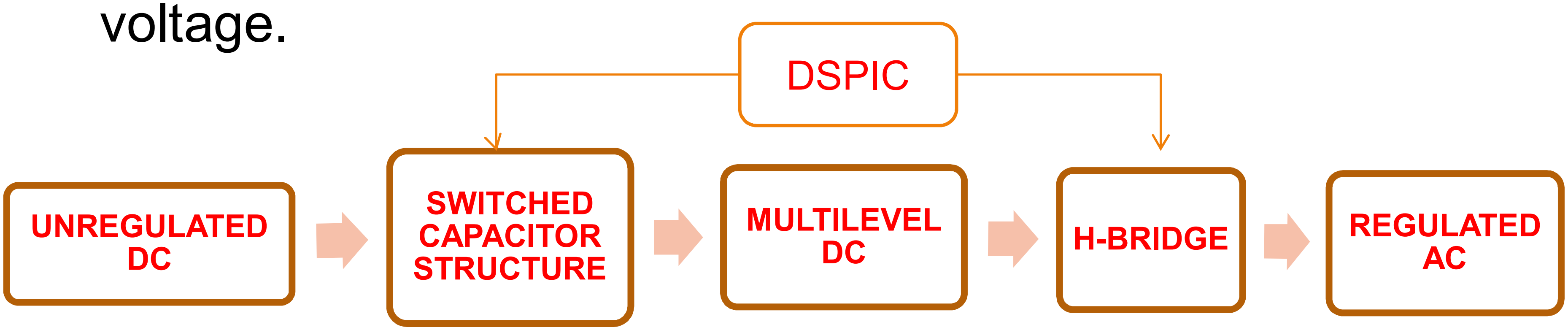
System Objective

The objective of the system is to achieve the following characteristics for a SC-MI:

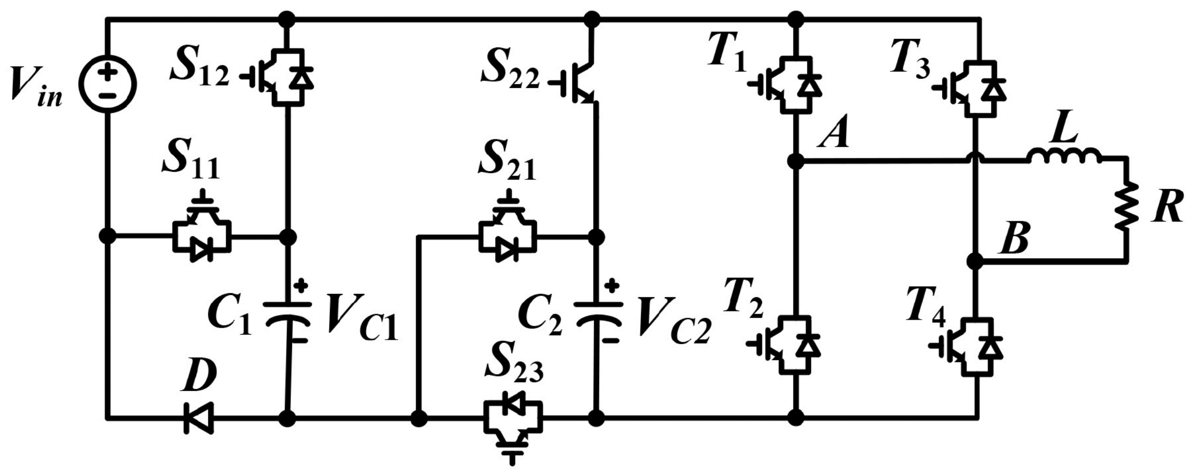
- Fewer components(switches, sources & capacitors)
- Smaller & less expensive.
- Less complex control.
- Requires only one power DC source.
- Boost operation without magnetic elements.

Principle

- Switched-capacitor (SC) structure is added to the H-bridge inverter.
- The SC structures use capacitors, switches, and diodes to create a multilevel DC voltage at the DC bus of the H-bridge circuit.
- H-bridge circuit inverts the multilevel DC voltage to AC voltage.



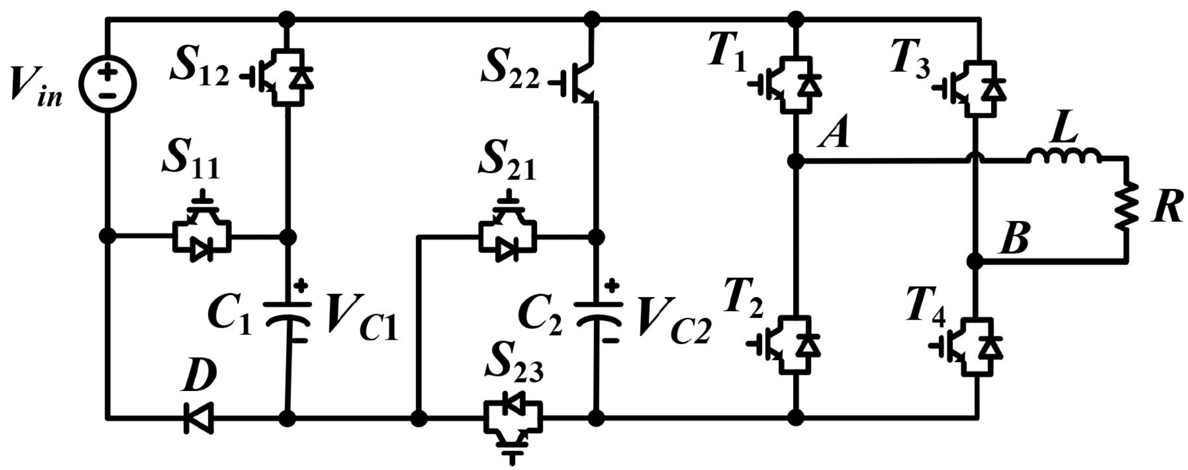
Schematic



SC nine-level inverter topology

The first SC cell :(C_1-D-S_{11}-S_{12}),
The second SC cell :(C_2-S_{21}-S_{22}-S_{23}).

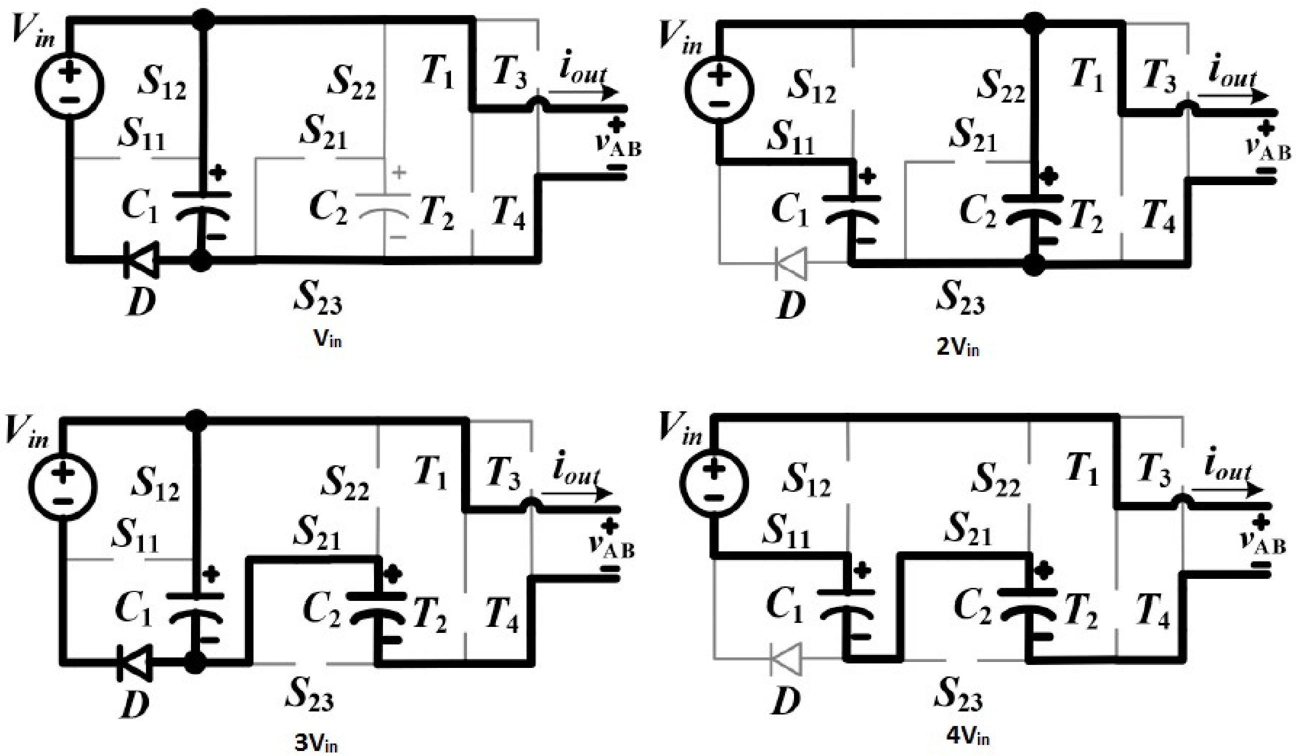
Principle



- C_1 is charged while connected in parallel with the input through S_{12}.
- It is discharged in series with the input through S_{11}.
- C_2 is charged by series combination of the input and C_1 through S_{11}, S_{22} and S_{23}.
- It is discharged in series with C_1 and the input through S_{21} and S_{11}.

C_1 is thus charged to V_{in} and C_2 is charged to $2V_{in}$.

Modes of operation



- 1V_{in} – Source and C_1 in parallel.
- 2V_{in} – Source and C_1 in series which is then parallel with $C_{2.}$
- 3V_{in} – Source and C_1 in parallel which is then series with $C_{2.}$
- 4V_{in} – Source, C_1 and C_2 all in series.

Stages of Work

- Literature survey
- Mathematical model of SCMI
- Design of 350W SCMI
- Simulation studies
- Prototyping
- Performance Analysis
- Improvements
- Documentation

Schedule

SEMESTER VII

- **PHASE I**
  - Problem identification(October 2018)
  - Formulating the Objective of the Project(October 2018)
- **PHASE II**
  - Literature Survey(November 2018)
  - Modelling(November 2018)

SEMESTER VIII

- **PHASE I**
  - Design of Proposed System and simulation study(January 2019)
  - Prototyping(February 2019)
- **PHASE II**
  - Performance Analysis and Improvements (March 2019)
  - Conclusion and Documentation (March 2019)

Current Progress

- Problem has been identified and studied.
- The system was identified as a viable solution.
- Most recent literature regarding the solution was collected and studied.
- Principle and working was studied.
- Mathematical model of the system prior to simulation studies is being synthesized in the current phase.

Expected Outcome

- Consistent solution to the identified problem.
- Prototype that can be implemented in large scale.
- Simulation Model of the proposed system.
- Documentation.

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Thank you