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(71)**Name of Applicant :**
1)Mrs.Rajani Kakunuri,
Address of Applicant :Mrs.Rajani Kakunuri, Assistant Professor, Department of Electrical&Electronics Engineering, Anurag Engineering College, Anathagiri, Kodad, Telangana-508206, krajini.eee@anurag.ac.in , Mobile No.8985774388 Telangana India
2)Mrs. M. Pallavi,
3)Dr. Juhi Nishat Ansari,
4)Kancharla Rajani,
5)Dr. Srinivasan Nagaraj,
6)Mr. Swaroop Mallick,
7)Dr.Ramana Pilla
8)Dr.CH.Asha Immanuel Raju
(72)**Name of Inventor :**
1)Mrs.Rajani Kakunuri,
2)Mrs. M. Pallavi,
3)Dr. Juhi Nishat Ansari,
4)Kancharla Rajani,
5)Dr. Srinivasan Nagaraj,
6)Mr. Swaroop Mallick,
7)Dr.Ramana Pilla
8)Dr.CH.Asha Immanuel Raju

(57) Abstract :
8. ABSTRACT OF THE INVENTION: The invention discloses an improved Modular Multilevel Converter (MMC) topology for HVDC transmission systems. The converter features arms (201) composed of a hybrid arrangement of Full-Bridge (205) and Half-Bridge (206) submodules, providing inherent DC fault blocking capability. A central controller (207) executes an Adaptive Capacitor Voltage Ripple Reduction (ACVRR) algorithm (208), which actively minimizes voltage stress on submodule capacitors by dynamically adjusting switching patterns based on instantaneous arm current, thereby improving reliability and reducing capacitor size. Each submodule is equipped with a local Decentralized Arm Energy Balancing Controller (DAEBC) (209) for robust internal energy management. An optimized thermal system (210) with advanced heat sinks ensures efficient cooling. The design enhances overall system efficiency, fault resilience, and operational lifetime, making it particularly suitable for long-distance power transmission and offshore wind farm integration, where reliability and maintenance costs are critical.

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