



**INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS**

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Programme of Study : Ph.D.
Thesis Title: Average Modeling and DC-Link Capacitor Voltage Regulation of SRF-dq Controlled Single-Phase ANPCI for Solar and Wind Power Applications
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SHORT ABSTRACT

An Active Neutral Point Clamped Inverter (ANPCI) is a combination of two popular multilevel inverters (MLIs), viz., NPC-MLI and Flying Capacitor (FC) MLI. It has low component count, offers low switching losses and high efficiency compared to many other MLIs. Owing to its advantages, the ANPCI has been proposed as an alternative to the NPC-MLI in medium voltage drives and renewable energy applications. In this thesis, the detailed operation and steady state analysis of single-phase ANPCI has been presented. Different capacitor voltage balancing strategies and PWM techniques for the ANPCI are discussed and their performance is compared. Further, a dynamic average circuit model (DACM) has been developed for the single-phase ANPCI in this thesis. The DACM can accurately predict the steady-state and transient performance of ANPCI in both open-loop and closed-loop with significantly low computational time and resources during system level studies. For the closed loop operation, an SRF-dq domain controller has been presented for the ANPCI. In this thesis, it is also proposed to integrate an external chopper circuit to the dc-link of ANPCI, to regulate the dc-link voltage ripple, thereby reducing the size of dc-link capacitors. Also different current control techniques are presented for the chopper circuit. The theory has been validated using detailed simulation and experimental studies. Further the chopper integrated ANPCI has been proposed as a Power Electronic Interface in solar and wind power generation systems and the performance is validated using PSCAD/EMTDC simulation.