

**UNIVERSITI TEKNOLOGI MARA**

**EMPIRICAL PROFILING OF  
GEOMAGNETIC INDUCED  
CURRENT (GIC) DUE TO SOLAR  
ACTIVITIES BASED ON SPHERICAL  
HARMONIC ANALYSIS**

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of the requirements for the degree of  
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**(Electrical Engineering)**

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## **CONFIRMATION BY PANEL OF EXAMINERS**

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## ABSTRACT

A highly charged particle oozed out from the Sun instantly with the intense geomagnetic storm drives geomagnetic induced current (GIC) activity. The main objective of the current work is to determine the main parameter of space weather that contribute to the GIC activity at low latitude region as well as to estimate the value of the GIC in order to develop and establish an empirical characterization of GIC activity. The geomagnetic field is used as the primary data extracted from the Magnetic Data Acquisition System (MAGDAS) for the six-station located at the low latitude and equatorial region. The result reveals that the solar wind dynamic pressure is well correlates to the GIC amplitude and represent the most significant space parameter towards GIC activity at low latitude region. The Symmetrical-Horizontal component (*SYM-H*) also correlates well to the GIC amplitude as the contribution from global magnetic indices. Other than that, the ionospheric current, *DP2* also significantly contributes to the GIC activity at the low latitude (BCL, LKW, and PTN) station. The mechanism that enhanced the *DP2* current at low latitude is due to the Cowling effect associated to the equatorial electrojet current (EEJ). The *DP2* current is dependent on the conductivity while the magnetospheric, *DL* current system was influenced by the pressure of the solar wind. The equation for GIC estimation has been produced by substituting the value of underground conductivity into the equation for GIC estimation. However, the estimation that only subjected to the selected low latitude stations. The empirical characterization of GIC activities at low latitude regions could be developed and established by considering all statistical analysis for the ten years' data. In overall, the GIC activity in low latitude region could be concluded as, the solar wind dynamic pressure act as the significant space parameter correlated well to the GIC amplitude at low latitude region while the global magnetic indices contribute to the GIC activity is represented by parameter of *SYM-H* component. The global current system has influenced to the GIC activity at the location of near or right on the equatorial region (BCL, LKW, and PTN) is the *DP2* current and the geo-electric field varied significantly during GIC activity. Last but not least, the more conductive region, the more GIC can be penetrated.

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