

A FRAMEWORK FOR UNIFYING EXCEPTIONAL HOLONOMY AND CALIBRATED GEOMETRY: MATHEMATICAL FOUNDATIONS AND RESEARCH DIRECTIONS

Kalpana Seetha¹ & Kiran Kumar G²

¹*Department of Mathematics, Kasireddy Narayan Reddy College of Engineering and Research, Abdullahpurmet, Near Ramoji Film City, Hyderabad, 501512, India*

²*Department of Mathematics, Dr. B.R. Ambedkar University, Etcherla, Srikakulam, Andhra Pradesh – 532410, India*

ABSTRACT

This research establishes a comprehensive framework unifying exceptional holonomy groups and calibrated geometric structures within Riemannian manifolds. We investigate the intrinsic relationships between holonomy reduction and the existence of calibrated submanifolds, particularly focusing on G_2 and $Spin(7)$ geometries. Our framework introduces novel computational methods for determining holonomy groups through differential form analysis and establishes correspondence theorems between calibration forms and parallel structures. The proposed system integrates analytical techniques with computational algorithms, providing explicit constructions for exceptional holonomy metrics and their associated calibrated geometries.

KEYWORDS: Exceptional Holonomy, Calibrated Geometry, G_2 Structures, $Spin(7)$ Manifolds, Riemannian Holonomy, Parallel Differential Forms

Article History

Received: 12 Jun 2024 | Revised: 15 Jun 2024 | Accepted: 20 Jun 2024
