

Harmonic geometric structures

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We give a twistorial interpretation of geometric structures on a Riemannian manifold, as sections of homogeneous fibre bundles, following an original insight by C. M. Wood (2003). The natural Dirichlet energy induces an abstract harmonicity condition, which gives rise to a geometric flow problem. We establish a number of analytic properties for this flow, such as uniqueness, smoothness, short-time existence, and sufficient conditions for long-time existence. This theory potentially subsumes a large class of geometric PDE problems from different contexts.

As an application, we recover the divergence-free torsion equation for G_2 -structures proposed by S. Grigorian (2017). We study the associated flow problem, which runs among isometric G_2 -structures, recovering analytic results independently established by L. Bagolini (2017), and S. Grigorian and Dwivedi-Gianniotis-Karigiannis (2019).