Characterization of curvature forms in dimension four

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Abstract: The problem involved is to know what differential 2-forms on a manifold M with values in a Lie algebra could be the local expression of the curvature of a connection on a principal fiber bundle, when the base manifold M is of dimension four. For a large class of Lie algebras including semisimple algebras, it is concluded that these 2-forms, under a genericity condition, are characterized as the solutions of a system of second order partial differential equations. It is remarkable that for every curvature 2-form solution of the system there is a unique corresponding connection and it is algebraically computable.