Differential geometry with a projection: Application to double field theory

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In recent development of double field theory, as for the description of the massless sector of closed strings, the spacetime dimension is formally doubled, i.e. from D to D+D, and the T-duality is realized manifestly as a global O(D,D) rotation. In this paper, we conceive a differential geometry characterized by a O(D,D) symmetric projection, as the underlying mathematical structure of double field theory. We introduce a differential operator compatible with the projection, which, contracted with the projection, can be covariantized and may replace the ordinary derivatives in the generalized Lie derivative that generates the gauge symmetry of double field theory. We construct various gauge covariant tensors which include a scalar and tensors carrying two or four O(D,D) vector indices. These are analogue to the scalar, Ricci and Riemann curvatures in ordinary differential geometry.

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