Geometry of loop spaces

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A Riemannian metric on a manifold $M$ induces a family of Riemannian metrics on the loop space $LM$ depending on a Sobolev space parameter $s$. We compute the connection forms of these metrics and the higher symbols of their curvature forms, which take values in pseudodifferential operators ($\Psi$DOs). These calculations are used to construct Chern-Simons classes on $TLM$ which detect nontrivial elements in the diffeomorphism group of certain Sasakian 5-manifolds associated to Kähler surfaces.