Fibre bundle framework for quantum fault tolerance LUCY LIUX-
UAN ZHANG, University of Toronto, DANIEL GOTTESMAN, Perimeter Institute
for Theoretical Physics — We introduce a differential geometric framework for de-
scribing families of quantum error-correcting codes and for understanding quantum
fault tolerance. In particular, we use fibre bundles and a natural projectively flat
connection thereon to study the transformation of codewords under unitary fault-
tolerant evolutions. We'll explain how the fault-tolerant logical operations are given
by the monodromy group for the bundles with projectively flat connection, which is
always discrete. We will discuss the construction of the said bundles for two exam-
ples of fault-tolerant families of operations, the string operators in the toric code and
the qudit transversal gates. This framework unifies topological fault tolerance and
fault tolerance based on transversal gates, and is expected to apply for all unitary
quantum fault-tolerant protocols.

Lucy Liuxuan Zhang
University of Toronto

Electronic form version 1.4