

# A Discrete Theory of Connections on Principal Bundles

MELVIN LEOK  
Control and Dynamical Systems  
California Institute of Technology  
Pasadena, CA 91125-8100, USA  
mleok@cds.caltech.edu

## Abstract

Motivated by applications to Discrete Lagrangian Reduction, we consider the discrete analogue of the Atiyah sequence of a principal bundle, and relate a splitting of the discrete Atiyah sequence with discrete horizontal lifts and discrete connection forms. Continuous connections can be obtained by taking the limit of discrete connections in a natural way.

This yields an isomorphism between  $(Q \times Q)/G$  and  $\tilde{G} \oplus (S \times S)$ . Both the discrete connection and the associated continuous connection are necessary to express the Discrete Lagrange–Poincaré operator in coordinates.