

# Differential equations on infinite-dimensional Lie groups

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Differential equations on non-normable locally convex spaces (or manifolds modelled on such) can be quite pathological: Examples of initial value problems without solutions are well-known, as well as examples of initial value problems with multiple solutions. The situation improves when only time-dependent, *left-invariant* vector fields are considered on a Lie group  $G$  modelled on a locally convex topological vector space  $E$ . Then solutions to initial value problems are always unique. Moreover, solutions exist for all classes of examples considered so far (when  $E$  is sufficiently complete), and depend smoothly on parameters. In technical terms, such Lie groups are *regular* in the sense of John Milnor. In the talk, I shall report on recent results concerning regularity properties of infinite-dimensional Lie groups, and their applications. Differential equations on  $G$ -manifolds given by time-dependent fundamental vector fields will also be discussed.