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**E. Kizil**

Instituto de Ciências Matemáticas, Universidade de So Paulo, Cx. Postal 668 – CEP 13.560-970, So Carlos – SP, Brasil  
kizil@icmc.usp.br

**J. Lawson**

Dept. of Mathematics, Louisiana State University, Baton Rouge, LA 70803, U.S.A.  
lawson@math.lsu.edu

**Lie Semigroups, Homotopy, and Global Extensions of Local Homomorphisms**

For a finite dimensional connected Lie group  $G$  with Lie algebra  $\mathfrak{g}$ , we consider a Lie-generating Lie wedge  $\mathbf{W} \subseteq \mathfrak{g}$ . If  $S$  is a Lie subsemigroup of  $G$  with sub-tangent wedge  $\mathbf{W}$  we give sufficient conditions for  $S$  to be free on small enough local semigroups  $U \cap S$  in the sense that continuous local homomorphisms extend to global ones on  $S$ . The constructions involve developing a homotopy theory of  $U \cap S$ -directed paths. We also consider settings where the free construction leads to a simply connected covering of  $S$ .

**Keywords:** Lie semigroup, local semigroup, Lie wedge, Lie group, homotopic paths, covering semigroups.

**MSC:** 22A15, 22E15