

<http://topology.auburn.edu/tp/>

---

# TOPOLOGY PROCEEDINGS



Volume 50, 2017

Pages 281–310

---

<http://topology.nipissingu.ca/tp/>

## ALGEBRAIC DYNAMICS

by

ERNIE MANES

Electronically published on March 3, 2017

This file contains only the first page of the paper. The full version of the paper is available to Topology Proceedings subscribers. See <http://topology.auburn.edu/tp/subscriptioninfo.html> for information.

---

### Topology Proceedings

**Web:** <http://topology.auburn.edu/tp/>

**Mail:** Topology Proceedings

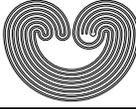
Department of Mathematics & Statistics

Auburn University, Alabama 36849, USA

**E-mail:** [topolog@auburn.edu](mailto:topolog@auburn.edu)

**ISSN:** (Online) 2331-1290, (Print) 0146-4124

COPYRIGHT © by Topology Proceedings. All rights reserved.



## ALGEBRAIC DYNAMICS

ERNIE MANES

**ABSTRACT.** Dynamical notions are introduced in arbitrary tight categories. The enveloping semigroup of  $X$  is the free object on one generator in the variety generated by  $X$ . Two new examples are dynamical systems in which all spaces are countably tight and compact spaces which are homeomorphic to their square. All dynamic varieties have a universal minimal object. Comfort types are identified with certain singly-generated submonads of the ultrafilter monad.

### 1. INTRODUCTION

Topological dynamics studies the action of a group on a locally compact Hausdorff space. It has long been known [2] that a point is almost periodic if and only if its orbit closure is minimal and compact. Beginning with the work of Robert Ellis [7] and continued by many others, the study of almost periodicity and the proximal relation for compact group actions was formulated in terms of very simple structure with the device of the enveloping semigroup.

The category of topological spaces and continuous maps is “loose” in that a subset of a space admits many topologies with the inclusion continuous, and a product of spaces admits many topologies making the projections continuous. Other familiar categories such as groups, or compact Hausdorff spaces are more “tight.” The notion of a “tight category” is defined in 1.4 below. A “dynamic category” is a tight category with extra structure to allow the ideas originated by Ellis [7] to develop dynamical notions in a more general setting. Ellis showed that when the theory of almost periodicity and proximality of section 4 below is applied to the

---

2010 *Mathematics Subject Classification.* 37B05, 54H20, 18C20, 18D99.

*Key words and phrases.* almost periodic, Comfort type, countable tightness, distal, enveloping semigroup, tight category.

©2017 Topology Proceedings.

This file contains only the first page of the paper. The full version of the paper is available to Topology Proceedings subscribers. See <http://topology.auburn.edu/tp/subscriptioninfo.html> for information.