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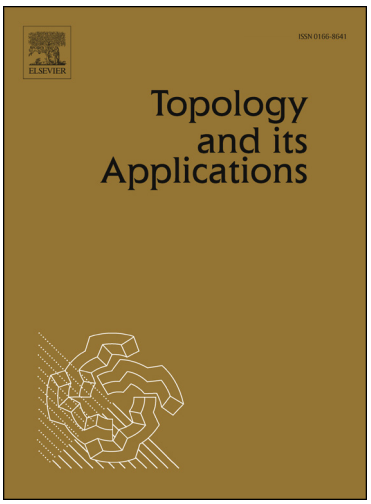

Zariski topology and Markov topology on groups

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ACCEPTED MANUSCRIPT

ZARISKI TOPOLOGY AND MARKOV TOPOLOGY ON GROUPS

DIKRAN DIKRANJAN* AND DANIELE TOLLER

Respectfully dedicated to the memory of Wis Comfort

Abstract. Every group G carries an intrinsically defined (by means of solution sets of one-variable equations) topology $\mathfrak{Z}_G$, named *Zariski* topology. It is related to another topology $\mathfrak{M}_G$ having as closed sets all unconditionally closed sets of G, named *Markov topology*, after Markov who implicitly introduced both topologies in dealing with a series of problems related to group topologies. The aim of this survey is to enlighten the utility of these topologies in resolving Markov problems, as well as other challenging problems in the area of topological groups, mainly related to topologization via group topologies with certain properties. We show that these topologies shelter under the same umbrella as distant issues as abelian groups and highly non-abelian ones, as permutation groups and homeomorphism groups.

Introduction

Ten years ago, at the 10-th Prague Topology Symposium, the first named author [22] gave a talk on the Markov-Zariski topology on Abelian groups. The results exposed in that talk, obtained jointly with Shakhmatov, were published later in [31]. Prior to that appeared the joint survey [29] with Shakhmatov, containing an entire section on the Markov-Zariski topology as well as the paper [30], containing a reflection principle characterizing the groups in which the Markov topology and the Zariski topology coincide. Later appeared also the survey [37] covering some of the progress obtained in the field of Markov-Zariski topologies within 2010. The aim of the current survey is to expose the wealth of recent progress in the field, with particular attention to the non-abelian case. In doing this we include, in particular, some of the unpublished results from the PhD thesis of the second named author with complete proofs. On the other hand, we include also a large section with some very recent results in the abelian case.

The survey is organized as follows. In §1 we recall two of the problems raised by Markov that triggered these two topologies, even if these topologies were not implicitly present on Markov's paper. In this section we discuss the connection of these topologies to the problems and recall the crucial precompact Markov topology introduced in [29]. In §2 we recall some partial Zariski topologies, namely topologies defined by the use of only some words, e.g., the centralizer topology or the monomial topology.

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