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2-chains and square roots of Thompson’s group $F$. (English) Zbl 1448.57029


The Thompson group $F$ is a remarkable finitely presented and 2-generated group which was introduced by R. Thompson in the 1960’s. A subgroup $\langle f, g \rangle \leq \text{Homeo}^+(I)$ is called a square root of $F$ if $(f^2, g^2)$ is isomorphic to $F$. In this paper the authors investigate this notion and show that there are square roots of $F$ enjoying surprising properties. For instance, the Thompson group $F$ does not contain the free group $F_2$ (and, in particular, it is not known whether $F$ is amenable or not). However, there is a square root containing $F_2$. Another interesting fact is that while the Thompson group admits a faithful action by $C^\infty$-diffeomorphisms of the circle, there are square roots that do not admit a faithful action by $C^2$-diffeomorphisms on compact 1-manifolds or on the real line. Moreover, the authors prove that there exist uncountably many square roots of $F$ and, in particular, there are square roots that do not admit a finite presentation. In this way, the authors provide answers to several questions posed by Brin. Finally the square roots of other subgroups are examined, like $\mathbb{Z}$ and the lamplighter group $\mathbb{Z} \wr \mathbb{Z}$.

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MSC:

57M60 Group actions on manifolds and cell complexes in low dimensions
37E05 Dynamical systems involving maps of the interval
57Q99 PL-topology
57S25 Groups acting on specific manifolds
20F60 Ordered groups (group-theoretic aspects)
20F14 Derived series, central series, and generalizations for groups

Keywords: Thompson’s group; orderable group; equations over homeomorphism groups; smoothable group actions

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