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Moduli Spaces of Weighted Stable Curves and their Fundamental Groups

The Deligne-Mumford compactification, $\overline{M}_{0,n}$, of the moduli space of n distinct ordered points on \mathbb{P}^1 , has many well understood geometric and topological properties. For example, it is a smooth projective variety over its base field. Many interesting properties are known for the manifold $\overline{M}_{0,n}(\mathbb{R})$ of real points of this variety. In particular, its fundamental group, $\pi_1(\overline{M}_{0,n}(\mathbb{R}))$, is related, via a short exact sequence, to another group known as the cactus group. Henriques and Kamnitzer gave an elegant combinatorial presentation of this cactus group.

We study a weighted variant of $\overline{M}_{0,n}(\mathbb{R})$ known as a Hassett space: For each of the n labels, we assign a weight between 0 and 1; points can coincide if the sum of their weights does not exceed one. Our goal is to find combinatorial presentations for the fundamental groups of Hassett spaces with certain restrictions on the weights. To proceed with our goal, we use two main approaches: The first approach is to recursively compute them using blowups, Seifert Van-Kampen, and knowledge for smaller n . The second approach is to express the Hassett space as a blow-down of $\overline{M}_{0,n}$ and modify the cactus group directly.