

Mathematical Physics of Hurwitz Numbers: Hurwitz Numbers and Moduli Spaces of Curves

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Hurwitz numbers enumerate ramification coverings of the Riemann sphere with a fixed configuration of ramification points and ramification types over these points. Equivalently, they enumerate all possible factorizations of a permutation of given cyclic type into a product of a given number of permutations of given cyclic types. Being a rather elementary combinatorial object, they are related to various domains in modern mathematics and mathematical physics: moduli spaces, Gromov-Witten theory integrable systems, and so on. Thus they could serve as a convenient elementary model for the study of all these domains.

2. Hurwitz Numbers and Moduli Spaces of Curves

The moduli space of complex curves is a deep and reach subject of modern algebraic geometry. The famous ELSV formula expresses the Hurwitz number as the intersection number of certain combination of characteristic classes over the moduli spaces of complex curves. This provides one of the simplest way to the study of the intersection theory of the moduli spaces. In particular, it leads to a relatively simple proof of Witten's conjecture on the intersection numbers over the moduli spaces that was proved earlier by M.Kontsevich by a different method.

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