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Complete Classification of Simple Current Modular Invariants for RCFT's with a Center $(\mathbf{Z}_p)^k$

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Abstract. Simple currents have been used previously to construct various examples of modular invariant partition functions for given rational conformal field theories. In this paper we present for a large class of such theories (namely those with a center that decomposes into factors $\mathbf{Z}_p$, p prime) the *complete* set of modular invariants that can be obtained with simple currents. In addition to the fusion rule automorphisms classified previously for *any* center, this includes all possible left–right combinations of all possible extensions of the chiral algebra that can be obtained with simple currents, for all possible current–current monodromies. Formulas for the number of invariants of each kind are derived. Although the number of invariants in each of these subsets depends on the current–current monodromies, the total number of invariants depends rather surprisingly only on p and the number of $\mathbf{Z}_p$ factors.

1. Introduction

As part of the program to classify all rational conformal field theories (RCFT's) – which is difficult and still far from being completed – one would like to classify all modular invariant partition functions of a given conformal field theory. This too has turned out to be a very hard problem, which so far has been solved completely only for a few special cases. In addition to some "free" theories those include the $SU(2)$ Kac–Moody algebras at arbitrary level [1] and some coset theories based on them. Furthermore one can always solve the problem by explicit computation if the number of primary fields is not too large. So far such computations have not provided much insight into the general solution to the problem.

There is however a subclass of modular invariants that should be more manageable, namely the class of invariants that can be obtained with simple currents [2]

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