COUPLED FREE FERMION CONFORMAL FIELD THEORY AND REPRESENTATIONS

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Conformal field theory (CFT) has become an active area of research beyond its origins in statistical physics and attracted much attention due to its intrinsic mathematical interest, which reveals deep connections with other diverse branches of mathematics. We study a specific subclass of CFTs that involve either uncoupled or coupled free fermions. Coupled free fermion CFTs arise from parafermion CFTs and lattice constructions. We analyse their representation spaces and reveal the exclusion statistics of coupled free fermions with universal chiral partition functions under specific bases. We explicitly decompose their modules into Virasoro modules of minimal models. We reveal an unexpected connection that integrates the coset construction, lattice construction and orbifold construction, which is supported by proving a range of character identities within the context of coupled free fermions. Simultaneously, we obtain explicit expressions of certain string functions in terms of Dedekind eta functions.

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