

Analytic Expressions for Singular Vectors of the $N = 2$ Superconformal Algebra

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Abstract: Using explicit expressions for a class of singular vectors of the $N = 2$ (untwisted) algebra and following the approach of Malikov–Feigin–Fuchs and Kent, we show that the analytically extended Verma modules contain two linearly independent neutral singular vectors at the same grade. We construct this two dimensional space and we identify the singular vectors of the original Verma modules. We show that in some Verma modules these expressions lead to two linearly independent singular vectors which are at the same grade and have the same charge.

1. Introduction

The highest weight representations of the Virasoro algebra play a crucial rôle in analysing conformal field theories. In most cases these representations contain singular vectors which lead to differential equations for the correlation functions and hence describe the dynamics of the system. Benoit and Saint-Aubin [3] gave explicit expressions for a class of the Virasoro singular vectors (the *BSA Virasoro singular vectors*). Using these results, Bauer, Di Francesco, Itzykson and Zuber developed a recursive method to compute all the Virasoro singular vectors [1, 2], the so called *fusion method*. This method can be used to give explicit formulae for the Virasoro singular vectors [15]. A completely different approach to this problem is the *analytic continuation method* which was developed by Malikov, Feigin and Fuchs for Kac–Moody algebras [13] and was extended to the Virasoro algebra by Kent [11]. Recently, Ganchev and Petkova developed a third method which transforms Kac–Moody singular vectors into Virasoro ones [10].

In a recent paper [6] we used the fusion method of Bauer et al. to find the analogues of the BSA Virasoro singular vectors for the $N = 2$ (untwisted) algebra. In theory the same method can be applied to obtain all uncharged singular vectors, but this turns out to be even more complicated than in the Virasoro case. It is however possible and of independent interest to use the analytic continuation method to find product formulae for all singular vectors, as we show in this paper.