Abstract

We study conformal symmetry breaking differential operators which map differential forms on $\mathbb{R}^n$ to differential forms on a codimension one subspace $\mathbb{R}^{n-1}$. These operators are equivariant with respect to the conformal Lie algebra of the subspace $\mathbb{R}^{n-1}$. They correspond to homomorphisms of generalized Verma modules for $\mathfrak{so}(n,1)$ into generalized Verma modules for $\mathfrak{so}(n+1,1)$ both being induced from fundamental form representations of a parabolic subalgebra. We apply the F-method to derive explicit formulas for such homomorphisms. In particular, we find explicit formulas for the generators of the intertwining operators of the related branching problems restricting generalized Verma modules for $\mathfrak{so}(n+1,1)$ to $\mathfrak{so}(n,1)$. As consequences, we derive closed formulas for all conformal symmetry breaking differential operators in terms of the first-order operators d, δ, $\bar{d}$ and $\bar{\delta}$ and certain hypergeometric polynomials. A dominant role in these studies is played by two infinite sequences of symmetry breaking differential operators which depend on a complex parameter λ. Their values at special values of λ appear as factors in two systems of factorization identities which involve the Branson-Gover operators of the Euclidean metrics on $\mathbb{R}^n$ and $\mathbb{R}^{n-1}$ and the operators d, δ, $\bar{d}$ and $\bar{\delta}$ as factors, respectively. Moreover, they naturally recover the gauge companion and Q-curvature operators of the Euclidean metric on the subspace $\mathbb{R}^{n-1}$, respectively.