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Generalization of a special class of interacting 2d BF models to an arbitrary even spacetime dimension from a BRST cohomology-based approach

Here, we generalize the 2d description of gravity theory via a self-interacting class of topological BF models to an arbitrary, even spacetime dimension, greater or equal to 8 (the 4d and 6d cases have been analyzed previously and were shown to lead to several types of couplings). Our methodology relies on a variant of deformation method based on a local cohomological BRST approach in the framework of the antibracket-antifield formalism computed in connection to a free, non-interacting collection of BF models with a special field spectrum. This spectrum is restricted such that to reveal only the interaction vertices that strictly generalize the 2d findings and thus 'hide'the expected zoo of vertices allowed in the case of a larger, for instance maximal BF field spectrum. If we denote the (even) spacetime dimension by 2k>6, then the restricted BF field spectrum leading to the searched for generalized vertices comprises only two collections of pairs of fields of minimum-maximum form degrees with respect to the maximally allowed spectrum, namely, (0,1) and (k-1,k). The main features of the generalized, interacting BF model can be synthesized into: 1. the self-couplings are parameterized by a unique set of functions allowed to depend at most on the undifferentiated zero-forms from the BF field spectrum with special symmetry properties (antisymmetric for k odd and symmetric for k even), 2. these parameterizing functions are not restricted by further conditions, normally needed to ensure the consistency of first-order deformations to all orders in the coupling constant (like in the initial 2d setting), and 3. all the relevant (gauge) quantities of the coupled model, including the interaction vertices, are nonlinear and may display some very general features related to the deformed set of generating gauge symmetries (an open gauge algebra and some on-shell reducibility relations) as long as the parametrizing function set is not further constrained (such as having a polynomial form).

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