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TOPOLOGICAL QUANTIZATION OF FREE MASSIVE BOSONIC FIELDS

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Abstract. We present the results of studying free massive bosonic fields under the formalism of topological quantization. We identify certain harmonic maps as a geometric configuration equivalent to the classical system. We take as a concrete example the case of free massive bosonic fields in two dimensions, and construct the fiber bundle representing them and find its topological spectra. We found that the appearance of singularities in Euler's two form caused its integral to be dependent on the order in which the variables are integrated. We discuss the implications of this orientation dependency and formulate a well-defined expression for the Euler invariant emerging from it.

1. Introduction

The formalism of topological quantization in the way we will understand it here was formulated in [7, 12]. In general, this formalism, has been constructed to find the discrete behaviour of physical quantities through topological properties associated to the physical system.

In order to apply this formalism we need a geometrical configuration which must be equivalent to the physical system we want to analyze, this means that the geometrical configuration must encode all physical information of the physical system. According to Patiño and Quevedo, we can apply this formalism in two ways: a) intrinsic topological quantization and b) induced topological quantization.

Both ways analyze the properties of an associated principal fiber bundle (PFB). The topological quantization is called intrinsic when the structure group of the PFB to be studied is determined by the intrinsic symmetries of the base space. In this case, the resulting PFB is equivalent to that of the tangent bundle. In the intrinsic topological quantization, we need a base space manifold M covered by open sets U_i and a metric g. The connection $\tilde{\omega}$ on the tangent bundle TM, coming from the lifting of the metric connection ω on M is the one satisfying the relation $\sigma_i^* \tilde{\omega} = \omega_i$ for any section σ_i defined over U_i, and the asterisk denotes the pullback