POSTERS

On the Simple Proof That S^{2n} Does Not Admit the Structure of a Topological Group

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It is a well known fact that among spheres S^n only S^1 and S^3 admit a topological group structure. Following the reasoning of I.S.-M. Megía we present an elementary proof that S^{2n} (for $n > 0$) cannot be equipped with such a structure.

The proof is based on the properties of homomorphism $f_* : H_n(S^n) \to H_n(S^n)$ of homology groups induced by a continuous map $f : S^n \to S^n$.

Persistent Homology for Defect Detection in Non-Destructive Evaluation of Materials

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Non-Destructive Testing (NDT) methods enable to inspect, examine and evaluate an object, material or system without compromising its future use. The detection of welding defects in steel tubes is one of the most common applications of NDT methods, particularly for ultrasonic testing. This technique uses changes in the propagation of ultrasonic waves to locate internal anomalies in the tested components. For an accurate characterization and allocation of the defects in the tubes, large datasets are generated, being the commonly used Time of Flight Diffraction (ToFD) method. Nowadays, the post-processing and interpretation of these data are still carried out manually depending on the expertise and the ability of a human operator, which could lead to errors. In this research study, we propose a novel methodology to analyse the data coming from ultrasonic testing of steel tubes based on persistent homology. This new concept permits the automatic detection of different types of defects in a short period of time, including crack propagations and pore defects. In

the resulting methods, the obtained data is deconvolved and then analysed using the Vietoris-Rips filtrations. This tool of topological data analysis enables us to distinguish between stable holes in the Point Cloud Data (PCD) that are related to real defects in the material and unstable holes. The proposed method from our work constitutes, to the best of our knowledge, a successful first attempt to apply Persistent Homology to automatically detect defects on steel tubes efficiently.

Handle Decomposition through a Morse Function

Marcin Sroka

The poster will illustrate how a manifold can be restored by analysing a certain Morse function on it. Steps of that process form so called handle decomposition of that manifold.