

ERC Advanced Grant 2019**Part B1****Stability and Testability: Groups and Codes****TeStability**

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- Name of PI's host institution for the project: The Hebrew University of Jerusalem
- Proposal duration in months: 60 months

Abstract

Stability in algebra in general and in group theory, in particular, is a general name for questions of the following type: Is every “almost solution” a small deformation of an “exact solution”? E.g. (a) Are two unitary matrices which almost commute small deformations of matrices that do commute? or (b) Is every “almost homomorphism” from a group Γ to topological group G , a small deformation of a true homomorphism? So (a) is a special case of (b), with $\Gamma = \mathbb{Z} \times \mathbb{Z}$ and $G = U_n(\mathbb{C})$.

In recent years, it has been discovered that “Group Stability” can be the path to the solution of some longstanding problems in group theory such as: Are all groups sofic? hyperlinear? (Two well known problems of Gromov and Connes, respectively).

In computer science, property testing is an area which studies the possibility of having (random) algorithms that can check a property while reading only a small amount of the information. A major problem here is: Are there good locally testable codes? Namely, error correcting codes for which one can decide with a high degree of certainty that a vector is in the code, while reading only a small number of its bits.

The current project will look at these group theoretic and codes problems from a unified point of view. Some partial works show that they are related to high dimensional expanders, Ramanujan complexes and to lattices in p -adic simple groups and their actions on the associated buildings. We plan to develop further methods to study stability and testability and eventually also to attack the holy grail problems of these areas.