UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

TRANSFORMATION OF THREE CRYSTALLOGRAPHIC GROUPS WITH MATRIX PRESENTATION INTO POLYCYCLIC

NURAIN MIEZA MAHIRAH BINTI MOHD SARIP – 2021101279
SITI NURAISHAH BINTI MUHKTAR – 2021100521
ANI AYUNI BINTI ZAINAL – 2021126039
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ABSTRACT

A Bieberbach group is a torsion free crystallographic group that represents an extension of a free abelian lattice group by a finite point group. This research began by taking the group offered in the Crystallographic Algorithms and Tables (CARAT) package, which is in the matrix form. These groups are shown to be polycyclic. Let's say, $G_2 = \langle a_0, a_1, l_1, l_2, l_3, l_4, l_5, l_6 \rangle$, where l_1, l_2, l_3, l_4, l_5 and l_6 are its lattices and its basis matrix is the identity matrix, this group is shown to be isomorphic to a new polycyclic group, namely $Q_2 = \langle a, b, c, l_1, l_2, l_3, l_4, l_5, l_6 \rangle$. A new generator *c* is constructed, and the group is shown to be polycyclic by collecting all possible relations formed by conjugation between each generator and the power of certain exponents. Thus, the polycyclic presentation can differ depending on the generator *c*. In this research, three Bieberbach groups with quaternion point group of order eight have been constructed to be polycyclic namely Q_2, Q_3 and Q_4. Later, the groups need to satisfy its consistency relations. In the future, by using these polycyclic presentations, researchers may consider computing the homological invariants of the groups.