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Marston Conder
Structural properties of graphs and maps
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1 Individual Project's contribution to the CRP

1.1 Aims and Objectives

The principal aim is to work collaboratively with other investigators on questions of mutual interest. We see a strong possibility of making significant progress on a number of topics with many principal investigators, including these:

- Building an atlas of regular and chiral polytopes, with small or given automorphism group (with PI Leemans and PI Pisanski).

- Structural investigation of half-arc transistive graphs, with application to construction of geometric configurations (with PI Marušič and and PI Pisanski).

- Coverings of symmetric graphs,networks and regular maps (with PI Marušič).

1.2 Methodologies

We will adopt the following approach that has proved remarkably successful in previous research across a wide range of topics:

1. Read and absorb background material (especially recent work by experts on the topic).

2. Discuss particular details with international colleagues (to ensure good understanding of the nature of current questions/issues and limitations of current state of knowledge).

3. Perform computer-assisted experiments to investigate basic cases.

4. Seek and identify patterns in computational data.

5. Formulate and test hypotheses (again with computational help if appropriate).

6. Attempt to verify the hypotheses theoretically.

For theoretical analysis, we will use techniques from combinatorial group theory, such as the Reidemeister-Schreier process, Schur's theory of transfer and centre-by-finite groups, and so on. In addition, we will use a range of other theoretical tools, such as Schreier cosets graphs to analyze and construct permutation representations of finitely-presented groups, and Sabidussi double-coset graphs to construct vertex- and arc-transitive graphs admitting a given group of automorphisms.

For computations, we frequently use MAGMA, a high-level computer system for handing discrete algebras (such as finitely-presented groups) and their quotients. This system has a highly valuable and versatile collection of structures and algorithms well suited to this kind of work.

2 Information on funding

Research grants:

2010 Alexander von Humboldt Stiftung, one-month resumption of research fellowship.

2010 Application to Marsden Fund (New Zealand) through to second stage, for a new 3-year joint project with Jianbei An and Eamonn O'Brien (Auckland).