RESEARCH STATEMENT

The theory of algebraic SEMIGROUPS (MONOIDS) began at a time when the theories of GROUPS and RINGS were well-developed branches of mathematics, exerting their influence on the whole of algebra as well as applications in the sciences. However, of recent, the theory of SEMIGROUPS has its scope widened to embrace many aspects of THEORETICAL COMPUTER SCIENCE as well as applications in the sciences.

Just as the study of symmetric and alternating groups forms an important part of group theory, so also the study of various semigroups of transformations makes a significant contribution to semigroup theory. For one thing such semigroups are a rich source of examples. But it is also clear that they are worth studying in their own right as 'naturally occurring objects'.

Inspired by the works of Howie (1966, 1971, 1978, 1981, 1982, 1984), Howie and Schein (1973), Gomes and Howie (1987), in my Ph. D. thesis I initiated a general study of the class of semigroups of order-decreasing (increasing) transformations. These transformations are also known as extensive, regressive and order-reducing in the literature. We obtained many analogous results as well as necessarily distinct results from earlier ones. The study also showed some connection with the work of Fountain (1977, 1982) and Pin (1984).

I have visited Prof. Higgins (Essex University) in 1999 [24] where we identified several congruences on the semigroup of order-decreasing finite full transformations and other related semigroups. Also in 1999 I participated in an International Workshop (at the University of Essex) where the participants tried to fashion out the future direction of research in the emerging area of quasi-crystals and partial symmetries.

Recently, I (with Prof. A. Laradji) have been interested in the combinatorial properties of various classes of semigroups of transformations [12 - 17] (publications) and [33 & 34] (submitted). We have also written six technical reports since 2003 [23-32]. Hitherto, these semigroups have been extensively studied in the case of totally ordered sets, but very few results were obtained in the case of posets. One of the main difficulties in this work is while there is only one totally ordered set of size n up to isomorphism, there are many non-isomorphic posets of the same size. In fact, for size 2, there are 2 posets; for size 3 there are 5 posets, for size 4 there are 11 posets, and their number increase geometrically (if not exponentially) with increase in n. I am therefore working toward generalizing the study of order-decreasing transformations to partially ordered sets and some interesting results are beginning to emerge. I also hope to begin some collaborative research work with people in theoretical computer science because of the enormous contribution of semigroup theory to that field.