# Abstract

An irregular assignment of a graph $G$ is a mapping from the edge set of $G$ to the numbers from 1 up to $k$ such that all vertex weights are pairwise distinct, where the vertex weight is the sum of labels of edges incident to that vertex. The irregularity strength $s(G)$ can be interpreted as the smallest integer $k$ for which $G$ can be turned into a multigraph $G'$ by replacing each edge by a set of at most $k$ parallel edges, such that the degrees of the vertices in $G'$ are all different.

The concept of reflexive irregular multigraphs proposed as a natural consequence of irregular multigraphs by allowing for loops. Irregular reflexive labeling includes also vertex labels which represent loops and thus the vertex labels are even numbers representing the fact that each loop contributes twice to the vertex degree, with 0 for a vertex without loops. The weight of a vertex under a total labeling is now determined by summing the incident edge labels and the label of the vertex itself.

A labeling which chooses labels for edges from 1 up to $k$ and takes even numbers from 0 up to $k$ as vertex labels is called an edge irregular reflexive labeling if different edges have different weights, where the weight of an edge is the sum of labels of end vertices of this edge and the edge label itself. The smallest value of $k$ for which such labeling exists is called the reflexive edge strength of the graph. In this thesis we will investigate the reflexive edge strength of cycles, Cartesian product of cycles, join of graphs, friendship graphs and generalized prism graphs.

We will also study the 3-total edge product cordial labelings of the graphs. Let the edges of a graph $G$ are labeled with numbers from 0 to $k-1$, for $2 \leq k \leq |E(G)|$. Consider the induced vertex labels defined as the product of labels of incident edges under modulo $k$. Then this edge labeling is called $k$-total edge product cordial if the difference of the number of vertices and edges labeled with $i$ and the number of vertices and edges labeled with $j$ at most 1, for every $i$ and $j$, $0 \leq i, j \leq k-1$. In Chapter 3 we will deal with 3-total edge product cordial labelings of honeycombs, some nanotubes, grids and generalized prisms.