

Graph Theory versus Signed Graph Theory

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In parallel to the classical graph theory there is an emerging theory of signed graphs, graphs where each edge receives a positive or a negative sign. By introducing signs into a graph, all its cycles become either balanced or unbalanced according to whether the sign product is positive or negative, respectively. This partition is fundamental: two signed graphs with the same underlying graph and the same list of balanced cycles are considered the same.

Distinguishing between balanced and unbalanced cycles in a signed graph is similar to distinguishing between even and odd cycles in an unsigned graph. As a consequence, many fundamental structures in graphs have their natural analogues in signed graphs. In this lecture we will discuss some of them, comparing analogous results where they exist. The emphasis will be on recent investigations of flows, colourings, cycle covers, and a few other structures that are important for both signed and unsigned graphs.