A survey on graph energy

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Abstract

The energy of a graph is defined as the sum of the absolute values of the eigenvalues of the graph. In the mathematical literature, this quantity was formally put forward in 1978 by Gutman, but its chemical roots go back to the 1940s. In spite of this, twenty years ago, only a few mathematicians would know what graph energy is, and only few of those would consider it as a topic worth of their interest. Then, somewhere around the turn of the century, a dramatic change occurred, and graph energy started to attract the attention of a remarkably large number of mathematicians, all over the globe, resulting in numerous significant discoveries, and in a remarkable number of publications. Since 2001 more than 300 papers on the energy were produced. This talks is devoted to giving a survey to the graph energy. The results are classified into seven categories: common proof methods; upper and lower bounds for the value of graph energy and the extremal graphs achieving these bounds; the energy of random graphs, extremal graphs in some classes of graphs; hyperenergetic and equienergetic graphs; hypoenergetic and strongly hypoenergetic graphs; various results on graph energy. Finally, other graph energies are also mentioned, such as the Laplacian energy, distance energy, etc.