

Combinatorial Problems Raised by Statistical Mechanics
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The combinatorics of classical invariant theory revisited by modern physics

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Abstract

We will consider the venerable subject of the classical invariant theory of binary forms, in the light of modern technology from physics. We will make the connection between the so-called symbolic method and the language of Feynman diagrams, as well as the graphical theory of angular momentum in quantum mechanics developed by Jucys, Penrose and many others. We will explain Gordan's 1868 original combinatorial construction of an explicit generating system of covariants, by a tree growth process: in our opinion one of the greatest works of algebraic combinatorics of all times.