Cut-Elimination by Resolution

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We present a cut-elimination method for Gentzen's LK which is based on the resolution calculus. The first step consists in a structural analysis of a proof P of a sequent S and the extraction of a clause term X(P). X(P) encodes an abstract structure of the derivations of cut formulas and represents an unsatisfiable set of clauses CL(P). A resolution refutation R of CL(P) then serves as a skeleton of an LK-proof P' of S with only atomic cuts. P' can be obtained from the resolution refutation R via so-called projections of the proof P w.r.t. the clauses in C(P). The main algorithmic advantage of this method called CERES lies in the integration of efficient theorem provers (constructing the resolution refutation R). The method can easily be extended to a large class of sequent calculi, including those with definition- and equality rules. Moreover the clause term of the proof paves the way for an algebraic analysis and a mathematical comparison of cut-elimination methods. E.g. it can be shown that CERES asymptotically outperforms a large class of "traditional" cut-elimination methods including this of Gentzen.