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Hypergeometric Solutions of Second Order Linear Differential Equations with Five Singularities.

Differential equations with Hypergeometric solutions are very common in Combinatorics and Physics. Given a second order linear differential operator L with rational function coefficients, we want to find (if it exists) a ${}_2F_1$-type solution of L. More specifically, we want to find a non zero expression:

$$y = \exp(\int r\,dx)\Big(r_0 S(f) + r_1 S(f)'\Big) \tag{1}$$

such that $L(y) = 0$, where $S(f) = {}_2F_1(a, b; c \,|\, f)$, and f, r, r_0, r_1 are rational functions.

Current projects in this area include (i) finding ${}_2F_1$-type solutions of second order differential operators with n regular singularities, and (ii) finding ${}_2F_1$-type solutions with specific degree of f.

If the generating function of an integer sequence is convergent and holonomic, then we observed that it satisfies a differential equation with logarithmic singularities which has ${}_2F_1$-type solution. This gives us a way to prove that the sequence is an integer sequence. In this talk, I will present an algorithm to find a ${}_2F_1$-type solution of a second order linear differential operator with five regular singularities where at least one singularity is logarithmic. (Received September 17, 2013)