Positive systems of polynomial equations

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Abstract: A positive system of polynomial equations is of the form $y = P(x, y)$, where $y = (y_1, \ldots, y_k)$ is a k-dimensional vector and $P(x, y) = (P_1(x, y), \ldots, P_k(x, y))$ a system of k polynomials with non-negatives coefficients in x and $y = (y_1, \ldots, y_k)$. Under quite natural conditions such systems have a unique solution $y(x) = (y_1(x), \ldots, y_k(x))$ of power series in x that have - by construction - non-negative coefficients and are algebraic functions. Such positive systems of polynomial equations appear naturally in many combinatorial questions. In contrast to arbitrary algebraic functions the Puiseux expansion at the dominant singularity of these functions (that determines the asymptotic behavior of the coefficients) is quite restricted, in particular the exponent can only be a dyadic rational number. This has been shown by Banderier and Drmota in 2015. Since we are in the framework of algebraic functions it is clear that full asymptotics of the coefficients of the functions $y_j(x)$ can be automatically determined. It is, however, a non-trivial problem to make this computation efficient, in particular for large systems of equations. The purpose of this talk to introduce the main results on positive systems of equations and to pose the efficiency computational question as an open problem.