

# Symbolic Summation in Difference Fields

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There are implementations of the celebrated Gosper algorithm (1978) on almost any computer algebra platform. Within my PhD thesis work I implemented Karr's Summation Algorithm (1981) based on difference field theory in the Mathematica system. Karr's algorithm is, in a sense, the summation counterpart of Risch's algorithm for indefinite integration. Besides providing a new approach to Karr's algorithm which allows us to find closed forms for a big class of multisums, I developed new extensions to handle also definite summation problems. More precisely I am able to apply creative telescoping in a very general difference field setting and are capable of solving linear recurrences in its context. In particular, I designed algorithms for finding appropriate difference field extensions to solve problems in symbolic summation. For instance I deal with the problem to find all nested sum extensions which provide us with additional solutions for a given linear recurrence of any order. Furthermore I find appropriate sum extensions, if they exist, to simplify nested sums to simpler nested sum expressions.