Capability and complexity of computations with integer Division

In this thesis computations with an operation set including integer division DIV in the unit cost model are considered. $CC_n(S)$, the families of languages $L\subset\mathbb{Z}^n$ that can be recognized by S-computation trees S-CTs with $S \subset\{+,-,*,*_c,DIV,DIV_c\}$, are characterized. They are completely characterized for $S=\{+,-,DIV_c\}$ and $S=\{+,-,*, DIV_c\}$ and for S={+,-,DIV} and S={+,-,*,DIV} only in the case n=1 and partially in the case of n>1 for S={+,-,DIV} und S={+,-,*,DIV}. The relations among the classes $CC_n(S)$ are completely determined and lower bounds for such S-Cts are proven.
The first nontrivial lower bound for $(\{+,-,*,DIV\},\mathbb{Q})$-CTs leaves a doubly logarithmic gap between the lower bounds for polynomial evaluation over {+,-,*} and {+,-,*,DIV}. This leads to the question if a polynomial p can be evaluated in o(deg p) over {+,-,*,DIV}. This is possible with N. Bshouty's algorithm in constant time restricted to a finite input set or over all integers with bitwise conjunction as an additional operation.
These results are used for acceleration of matrix multiplication, of determinant computation over {+,-,*,DIV} and of matrix powering over {+,-,*,DIV,gcd}.