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A generalisation of Miller's algorithm and applications to pairing computations on abelian varieties

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Abstract: In this paper, we use the theory of theta functions to generalize to all abelian varieties the usual Miller's algorithm to compute a function associated to a principal divisor. We also explain how to use the Frobenius morphism on abelian varieties defined over a finite field in order to shorten the loop of the Weil and Tate pairings algorithms. This extends preceding results about ate and twisted ate pairings to all abelian varieties. Then building upon the two preceding ingredients, we obtain a variant of optimal pairings on abelian varieties. Finally, by introducing new addition formulas, we explain how to compute optimal pairings on Kummer varieties. We compare in terms of performance the resulting algorithms to the algorithms already known in the genus one and two case.

Category / Keywords: foundations / Pairings, Abelian varieties

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