Abstract

In order to improve the efficiency of elliptic curve multiplication methods, extended and composite elliptic curve operations such as \( nP, mP + Q \), where \( n > 2 \) and \( m \geq 2 \), and repeated doublings were proposed. These operations have lower complexity, in terms of field operations, than that for classical methods. Moreover, they are supposed to replace the classical methods. In this paper, repeated doublings and odd point computation are deeply analyzed in order to measure their actual efficiency. According to the gained results, the improvement ratio in the execution time is not the same as the improvement ratio measured in terms of field operations. Moreover, different implementations of Sakai repeated doubling method yield different results. For example, implementing \( 4P \) as a separate function gives lower complexity than implementing repeated doublings as a general function. On the other hand, other methods for computing \( nP \), where \( n \) is odd, have been analyzed. Dahmen method failed to meet the expected results for computing odd points in elliptic curve multiplication methods that employ the on-the-fly strategy since its time complexity was more than that for classical methods. It was also found that new techniques should be devised to improve the efficiency of window methods for calculating odd points such as: \( 5P, 7P, \) and \( 15P \), which have lower cost than that for classical method.
References

Evaluating Composite EC Operations and their Applicability to the on-the-fly and non-window Multiplication Methods


**Index Terms**

Computer Science

Information Science

**Keywords**

Repeated doublings extended elliptic curve operations pre-computations single scalar multiplications

recoding methods