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Small Public Keys and Fast Verification for Multivariate Quadratic Public Key Systems

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Abstract: Security of public key schemes in a post-quantum world is a challenging task---as both RSA and ECC will be broken then. In this paper, we show how post-quantum signature systems based on Multivariate Quadratic (MQ) polynomials can be improved up by about 9/10, and 3/4, respectively, in terms of public key size and verification time. The exact figures are 88% and 73%. This is particularly important for small-scale devices with restricted energy, memory, or computational power. In addition, we show that this reduction does not affect security and that it is also optimal in terms of possible attacks. We do so by combining the priory unrelated concepts of reduced and equivalent keys. Our new scheme is based on the so-called Unbalanced Oil and Vinegar class of MQ-schemes. We have derived our results mathematically and verified the speed-ups through a C++ implementation.

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