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Attractive Subfamilies of BLS Curves for Implementing High-Security Pairings

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Abstract: Barreto-Lynn-Scott (BLS) curves are a stand-out candidate for implementing high-security pairings. This paper shows that particular choices of the pairing-friendly search parameter give rise to four subfamilies of BLS curves, all of which offer highly efficient and implementation-friendly pairing instantiations.

Curves from these particular subfamilies are defined over prime fields that support very efficient towered options for the full extension field. The coefficients for a specific curve and its correct twist are automatically determined without any computational effort. The choice of an extremely sparse search parameter is immediately reflected by a highly efficient optimal ate Miller loop and final exponentiation. As a resource for implementors, we give a list with examples of implementation-friendly BLS curves through several high-security levels.

Category / Keywords: Pairing-friendly, high-security pairings, BLS curves.

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