1 SchemeIBME

This scheme is only applicable to symmetric groups of prime orders.

1.1 $\mathbf{Setup}() \to (\boldsymbol{mpk}, \boldsymbol{msk})$

generate $r, s \in \mathbb{Z}_p^*$ randomly
generate $P \in \mathbb{G}_1$ randomly
$P_0 \leftarrow r \cdot P$
$H_1 : \mathbb{Z}_p^* \to \mathbb{G}_1$
generate $mask, \|mask\| \leftarrow \|e\|, e \in \mathbb{Z}_p^*$ randomly
$H' : \mathbb{Z}_p^* \oplus mask \to \mathbb{G}_1$
$mpk \leftarrow (P, P_0, H, H')$
$msk \leftarrow (r, s)$
return (mpk, msk)

1.2 $\mathbf{SKGen}(S) \to \boldsymbol{ek}_S$

$ek_S \leftarrow s \cdot H'(S)$
return ek_S

1.3 $\mathbf{RKGen}(S) \to \boldsymbol{dk}_R$

$H_R \leftarrow H(R)$
$dk_1 \leftarrow r \cdot H_R$
$dk_2 \leftarrow s \cdot H_R$
$dk_3 \leftarrow H_R$
$dk_R \leftarrow (dk_1, dk_2, dk_3)$
return dk_R

1.4 $\mathbf{Enc}(\boldsymbol{ek}_S, R, M) \to C$

generate $u, t \in \mathbb{Z}_p^*$ randomly
$T \leftarrow t \cdot P$
$U \leftarrow u \cdot P$
$H_R \leftarrow H(R)$
$k_R \leftarrow e(H_R, u \cdot P_0)$
$k_S \leftarrow e(H_R, T + ek_S)$
$V \leftarrow M \oplus k_R \oplus k_S$
$C \leftarrow (T, U, V)$
return C

1.5 $\mathbf{Dec}(\boldsymbol{dk}_R, S, C) \to M$

$k_R \leftarrow e(dk_1, U)$
$H'_S \leftarrow H'(S)$
$k_S \leftarrow e(dk_3, T)$
$M \leftarrow V \oplus k_R \oplus k_S$
return M