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Simultaneous Decompression Based Cipher.

Let $|\boldsymbol{u}^1| = \delta_1$ and $|\boldsymbol{u}^2| = \delta_2$ where $\gcd(\delta_1, \delta_2) = 1$. The simultaneous decompression of $(\boldsymbol{u}^1, \boldsymbol{u}^2)$ is defined as the set of binary vectors $\boldsymbol{v} \in \boldsymbol{V}$ satisfying $u^1_j = \sum_{k=0}^{\delta_2 - 1} v_{k\delta_1 + j}$ for each $j \in \mathbb{Z}_{\delta_1}$ and $u^2_j = \sum_{k=0}^{\delta_1 - 1} v_{k\delta_2 + j}$ for each $j \in \mathbb{Z}_{\delta_2}$. We exploit the isomorphism $\mathbb{Z}_{\delta_1\delta_2} \cong \mathbb{Z}_{\delta_1} \times \mathbb{Z}_{\delta_2}$ to formulate these constraints as a multi-dimensional Subset Sum problem with binary matrix solutions. The set of these matrices allows a graph representation, $\mathbb{G}_{\boldsymbol{V}}$, that is conjectured to contain a Hamiltonian cycle. It follows each $\boldsymbol{v}$ may be uniquely represented by linearly-independent indices of $(\boldsymbol{u}^1, \boldsymbol{u}^2)$ and integer distance along this cycle. We construct a small example on $\delta_1\delta_2 = 21$ for demonstration, and discuss the pros and cons of this structure with respect to the principles of cryptography. (Received August 16, 2020)