Fixing non-randomness in PGVs

Gauravaram, Praveen

Publication date:
2010

Document Version
Early version, also known as pre-print

Link back to DTU Orbit

Citation (APA):
Gauravaram, P. (2010). Fixing non-randomness in PGVs [Sound/Visual production (digital)]. 30th Annual International Cryptology Conference, Santa Barbara, CA, United States, 15/08/2010, http://rump2010.cr.yp.to/

Fixing non-randomness in the PGVs

Praveen Gauravaram, Nasour Bagheri* and Lars R.Knudsen

DTU, Denmark and IUST, Iran*

17th August 2010

Single block length compression functions

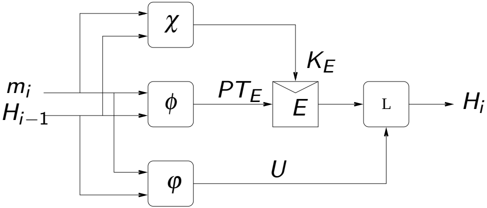


Figure: General form of a *n*-to-*n* bit PGV compression function

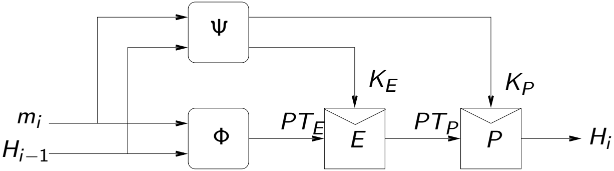
1. χ, ϕ and φ define linear combinations of m_i and H_{i-1}.
   - $K_E, PT_E, U \in \{m_i, H_{i-1}, m_i \oplus H_{i-1}, v\}$
2. Preneel, Govaerts and Vandewalle (PGV) showed 12 out of 64 possible designs are collision and (second) preimage resistant.
3. Black, Rogaway and Shrimpton confirmed this result in the ideal-cipher model.

Non-randomness in PGVs

For each f^i, it is possible to find a pair (H_{i-1}, m_i) which makes f^i non-ideal even if E is ideal.

Compression function (f^i)	Property
$i \in \{5, 8, 10, 11\}$	$f^i(H_{i-1}, m_i) = H_{i-1}$ (fixed points)
$i \in \{2, 3, 6, 7\}$	$f^i(H_{i-1}, m_i) = H_{i-1} \oplus m_i$
$i \in \{1, 4, 9, 12\}$	$f^i(H_{i-1}, m_i) = m_i$

General form of a $2n$-to-n-bit Modified PGV compression function



1. Ψ and Φ define linear combinations of m_i and H_{i-1}:
2. $K_E, K_P, PT_E \in \{m_i, H_{i-1}, m_i \oplus H_{i-1}, v\}$
3. Sixty-four MPGVs can be derived from it.

Results

1. Two ideal and independent block ciphers are sufficient to design indifferentiable compression functions. 24/64 MPGVs are indifferentiable.
   1. The modified versions of 12 collision resistant PGVs are indifferentiable up to the birthday bound.
   2. Some surprises.
2. Interesting applications.

Thank you!!!!