

## New Self-dual [78, 39, 14] Codes an Automorphism of Order 13

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We apply a method for constructing binary self-dual codes having an automorphism of odd prime order  $p$  ([1], [2]) for  $p = 13$ . The main idea of the method is to decompose the binary self-dual code  $C$  into a direct sum of two subcodes:  $F_\sigma(C)$  consisting of all codewords invariant under the action of the automorphism, and  $E_\sigma(C)$  with vectors that have even weight on all cycles and fixed points.

Using the orthogonal condition and also the structure of  $E_\sigma(C)$  as a submodule of  $\mathcal{P}^c$ , where  $\mathcal{P} \cong \mathbb{F}_{2^{12}}$  in the factor ring  $\mathbb{F}_2[x]/\langle x^{13} - 1 \rangle$ , we obtain exactly 322103 inequivalent codes  $E_\sigma(C)$  with  $d \geq 14$ . Combining the two subcodes of  $C$ , we achieve full classification of optimal binary self-dual [78, 39, 14] codes having a fixed points free automorphism of order 13. The total number of such codes is 1592 and among them are codes with 6 new values of the integer parameters in their respective weight enumerator. The cardinality of the automorphism groups are 78 (for 10 codes), 39 (for 2 codes), 26 (for 70 codes) and 13 (for 1510) codes.

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## References

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