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THE DEPARTMENT OF MATHEMATICAL SCIENCES PROUDLY PRESENTS

COLLOQUIUM

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A New Family of 3D Watermarks

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We construct 3D arrays that are suitable for watermarking video by composing a $p \times p$ Legendre array with a sequence of elements of $\mathbb{F}_p \times \mathbb{F}_p$. The peak auto-correlation value of such an array is $C(p^2-1)$ where C is the length of the sequence of shifts and the non-peak auto-correlation values, as well as the cross-correlation values of any two such arrays are of the form kp^2-C where $k \geq 0$. Optimal correlation values that can be obtained by this type of construction are obtained by minimizing k. We study 3D arrays composed from a Legendre array and sequences generated by the points of an elliptic curve over a prime field. We show that in this case the maximum value of k is 3 and we give examples of these constructions in which k is 1 or 2. We present experimental results that show that the linear complexity of our constructions is approximately the same as other known 3D constructions and that the value of the complexity is independent of the size of the array. Finally, we briefly discuss experimental results of inserting our 3D watermarks into video.



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