Chapter 19

A Nearly One-to-One Method to Convert Analog Signals into a Small Volume of Data: Second Part: 2-D Signals and More

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ABSTRACT

This article is an extension for 2-D analogue signals (and more) of the methods presented in “A nearly One-to-One Method to Convert Analog Signals into a Small Volume of Data” which was published in an earlier issue. This new conversion method may save the storage space, the bandwidth of the transmitting channels and the necessary energy for transmission. It may be particularly interesting for the space communications and/or information storage but also for TV transmissions to save spectrum, especially for the coming 3-D TV. Once a successful realization of a dedicated software and hardware able to realize the conversion in “real time”, new standard with a better quality and low data volumes may be considered for the 2-D and also for the 3-D signals transmission and/or storage. This conversion method may be considered also as a “public key encryption” and may insure a good (or even very good) security of information. Due to the high sensitivity of parameters of this coding/decoding procedure, especially for higher compression factors, and to the big number of the used parameters, this method may be also considered as a strategic information technology.

INTRODUCTION

Sounds are considered as 1-D signals but the images as 2-D signals. There exist many manners to extend 1-D to 2-D. A geometrical manner to conceive the extension to more dimensions is to start from a dimensionless point placed at the “origin” of the space coordinates. Physically, the origin point of the space coordinates may be considered the point where the observer is placed. Now, we choose a given direction in space and move this dimensionless point in that direction. It results a
line that may be considered as a “support” for 1-D signals if these signals are send in this direction. Let now consider an orthogonal direction and move the line on this new direction. It results a plane in which 2-D signals may be placed. Further, if will consider now a new orthogonal direction and move the plane on this new direction it results a volume where 3-D signals may be placed. Of course, this procedure may be extended to more than 3 dimensions. Figure 1 represents these line, plane and volume and Figure 2, the manner to pass to 4-D.

It may be remarked that:

- All the considered directions have to be orthogonal. Then, they formed an equivalent orthogonal system of coordinates.
- Only the first direction may be arbitrarily chosen; all the other directions results by orthogonal properties.
- For 1-D signals, the signal direction in space may be considered also as its time-support and then, mathematically, correspond to (one of) the independent variable of the function that represent it. Then, the actual equivalent position in space of the signal may be deduced by considering its velocity.
- For more than 1-D, the movement is “collective”: all the points of the plane, volume and so on are in move together. As a simple physical example, a scanner or a photocopier machine process the 2-D signals (images) by moving a light line.
- The 2-D signals may be “still”, like the photos and/or depending of the time like for “movies”. In this last situation, the direction of the time support may be independent of the space coordinates of any frame of the movie but all the “pixels” of any frame (image) move collectively at the same instant. Chemical sensor process at a same time the whole image but electronic sensors uses generally a given scanning procedure. This last procedure is equiva-
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