

The present invention relates to the visual display of radar information with the use of a digital image converter; the subject more particularly is a method of assigning radar recurrences to visually displayable radials, as well as its implementation means.

When it is desired to display an image supplied in polar coordinates, such as a radar image, on a visual display device operating in television mode, a device called digital image converter, or DIC, is generally used, which has the essential role of converting the image in polar coordinates into an image in cartesian coordinates and of storing it in digital form, in such a way as to provide the matching between the rate of delivery of the images and the rate of renewal of the television image.

A DIC conventionally includes: a radar interface circuit, which receives the video signals originating from the radar and digitizes them; a coordinate conversion subassembly; a memory, called image memory, in which the radar information is stored in digital form in the format in which it will be displayed. In relation with the image memory, the DIC also includes artificial remanence circuits which have the role, for the information of the image memory for which there are no alterations due to ageing, of creating a remanence effect, comparable to that which is produced on a remanence tube in which the brightness of a point starts to decrease as soon as it is written. In such a system, the process of writing in memory is as follows.

The video signal is constituted by the responses (echoes) to a pulse transmitted by the radar; it is supplied at a frequency which is the repetition frequency of the transmission of these pulses, called PRF (for "Pulse Repetition Frequency"). It should be noted that the PRF frequency is determined by the range of the radar. The video signals supplied at the PRF frequency are called "recurrence" from now on.

The coordinate conversion subassembly, in order to carry out its conversion, receives "rotation signals"

which have the role of indicating the angular position of the beam of the radar at any moment, the beam turning regularly with respect to a reference direction, generally the North; the rotation signals are constituted, on one hand, by a North signal (N, which is a pulse, or pip, upon each passing of the beam to the North and, on the other hand, by an angle increment pulse, or pip, ( $\epsilon$ ) indicating that the beam has turned by  $1/n^{\text{th}}$  of a rotation with respect to the preceding increment, if  $n$  increments correspond to  $360^\circ$ .

The  $\epsilon$  angle increment pips are supplied in general by the antenna coder, asynchronously with respect to the recurrences. The resulting angle, at a given instant, which the beam of the radar makes with the reference direction (North) is called  $\theta$ . The video information assigned to each of the  $n$  directions  $\theta$  of the beam is called "radial" from now on.

When the radar system supplies  $n$  angle increments, it is generally wished to display  $n$  radials. It is then necessary to assign the various recurrences to the various radials. The different points of each radial thus constituted are next written into image memory at the addresses calculated in cartesian coordinates.

However, the periodicity of the  $\epsilon$  angle increments being given by the antenna and the PRF frequency being defined moreover by the range of the radar, it appears that in certain cases these values may be such that one or the following configurations is found:

- either the frequency of the  $\epsilon$  increments is too low with respect to the PRF frequency: among the recurrences received at the PRF frequency, there are then recurrences which do not correspond to any value of  $\theta$ ; either they are not written into memory and they are lost, or they are grouped together in advance, in a way which may not be constant from one radial to the other, or from one antenna rotation to the other, and written into memory; this results in an error of positioning the echoes; moreover, this error may vary from one antenna

rotation to the other;

- or the frequency of the  $\epsilon$  increments is too high with respect to the PRF frequency and there are values of the angle  $\theta$  for which there is no corresponding radar information (recurrences) available: there is then no writing into memory, for lack of information; the drawback of this is especially an irregularity in the image for want of a radial from time to time, as well as a disturbance of the operation of the remanence.

In order to avoid this latter drawback, the PRF frequency must be modified in practice, in a sense leading to limiting the range of the radar.

Another solution is described in the European Patent Application published under No. 0,192,562 in the name of THOMSON-CSF, according to which the periodicity of the  $\epsilon$  increments is converted into a signal  $\epsilon'$  as a function of the PRF frequency of the radar, so as to avoid any loss of information; the coordinate conversion and the assigning of the recurrences are then done according to the converted value  $\epsilon'$ . This method amounts to limiting the number of radials actually viewed with respect to the number of values of the angle  $\theta$  given by the antenna, that is to say to the number of radials which it would be possible to view, giving rise to a limitation in the quality of the image viewed.

The present invention makes it possible to avoid these latter defects and limitations by making it possible to view as many radials as the antenna supplies values of the angle  $\theta$ . It makes it possible to assign the incident recurrences to the visually displayable radials whatever the type of the radar, that is to say whatever the ratio between the frequency of the increments  $\epsilon$  and the PRF frequency, by carrying out the decoupling of the information received (recurrences at the PRF frequency) with the information intended for visual display (radials), thus allowing optimization in the use of the DIC.

More precisely, the DIC implementing the method according to the invention includes a subassembly

receiving the  $\epsilon$  signal and a radar synchronization signal  $SY_R$  constituted by pulses, or pips, at the PRF frequency and carrying out a grouping function in the following way:

5           - memory storage of the incident recurrences at their arrival rate (PRF) in one of the memories of a group including  $m$  memories,  $m$  being at least equal to 3, the identification of the memory being written to being changed upon the first  $SY_R$  pip following the reception of  
10   an  $\epsilon$  pip modulo  $m$ ;

          - if appropriate, grouping of an incident recurrence with an already-stored recurrence;

          - reading of at least one memory on reception of each  $\epsilon$  pip, the identification of the memory to be read  
15   being obtained on the basis of that of the memory being written to at this moment.

Other objects, features and results of the invention will emerge from the following description, given by way of non-limiting example and illustrated by  
20   the attached drawings, which represent:

          - Figures 1 and 2, explanatory diagrams of the processes of quantification and of grouping of the incident radar information;

          - Figures 3a and 3b, the timing diagrams of the  
25   reading and of the writing of the various recurrences and radials in the method according to the invention;

          - Figure 4, a flow chart of the method according to the invention;

          - Figure 5, an embodiment of the device for  
30   implementing the method according to the invention;

          - Figure 6, the block diagram of a DIC implementing the method according to the invention.

In these different figures, the same references relate to the same elements.

35           Figures 1a, 1b and 1c illustrate the process of quantification in range of the incident radar video signal.

Figure 1a illustrates, as a function of time, the video analog signal, marked 12, as it is supplied by the

radar receiver.

On this figure are also drawn the radar synchronization pips denoted  $SY_R$ , sent in synchronism with the transmission of the radar pulse whose video signal 12 constitutes the response. A recurrence, that is to say the radar video signal between two  $SY_R$  pips, marked 10 and 11, is designed by Rec.

The input interface of the DIC has the function of digitizing this analog video signal: this is what is represented in Figure 1b, where the same recurrence Rec is again found and where a number of samples have been featured, marked 13, of frequency  $H_s$  and whose envelope is the video signal 12. Each of the samples is expressed in digital form over  $b$  bits.

As is known, the sampling frequency is a function of the pulse width of the radar. The total number of samples necessary between two  $SY_R$  pips may be large and exceed the processing capabilities of the DIC; a regrouping of these samples is then carried out into what will be called from now on "quanta" whose frequency, denoted  $H_q$ , is less than or equal to the sampling frequency  $H_s$  and is therefore a function of the maximum processing capacity of the DIC.

The succession of quanta, marked 14, is represented in Figure 1c between the synchronization pips 10 and 11.

The function applied to two (or more) samples so as to group them into a quantum is, for example, a maximum function, it being understood that other functions are possible, such as the average function.

Figures 2, a and b, illustrate the notion of radial.

Figure 2a is a spatial diagram in polar coordinates of a succession of recurrences  $Rec_1$ , from the centre of the radar, marked  $C_R$ .

It is recalled that each recurrence corresponds in time to a radar pulse, or also to an  $SY_R$  synchronization pip.

As was indicated above, the only angular

information available making it possible to place the video represented by the quanta on a monitor screen consists of the  $\epsilon$  pips: it is then necessary to assign to each recurrence an angle value obtained by counting the  $\epsilon$  pips, from a time origin consisting of the North pip.

In Figure 2b is represented the case where, the PRF frequency being higher than the frequency  $H_s$  of the  $\epsilon$  pips, it is necessary to carry out a regrouping of the recurrences assigned to the same angle value in order to form a radial, marked  $Rad_i$ , each of the radials being separated by the angle  $\epsilon$ . It should be noted that in the present description both the pulse indicating an angle increment, and the angular value of the fraction  $360^\circ/n$  are designed by  $\epsilon$ .

Each quantum of this resultant radial is therefore spatially defined by its distance  $\rho$  from the radar centre  $C_R$  (which is in fact given by the number of the quantum counted from the time origin which constitutes the synchronization pip) and the angle  $\theta$  of a radial with respect to the North (which is obtained by counting the  $\epsilon$  pips from the time origin which the North pip constitutes).

Figures 3, a and b illustrate the method of assigning incident recurrences to a number of visually displayable radials which is defined by the radar, this method being carried out with the aid of a set of  $m$  memories in which the incident recurrences are written and read according to a particular sequencing. In the example represented in Figure 3, the number  $m$  of memories is equal to 3.

Figure 3a represents the case where the PRF frequency is higher than the frequency of the  $\epsilon$  pips.

It relates to a timing diagram illustrating the sequencing of the  $SY_R$  synchronization pips (at the PRF frequency), of the  $\epsilon$  signals and of the read and write phases in each of the three memories, marked  $M_1$ ,  $M_2$  and  $M_3$ .

On the first line, representing the  $SY_R$  synchronization pips, marked  $S_0$  to  $S_6$ , are also indicated

the succession of the recurrences: the last recurrence of the preceding antenna rotation, marked  $\text{Rec}_N$ , then the first seven recurrences of a rotation, indexed from 1 to 7.

5           On the second line of the diagram are represented the  $\epsilon$  pips, the first indicating the passage of the radar beam to the North. The frequency of the  $\epsilon$  pips being lower in this hypothesis than the PRF frequency, only four  $\epsilon$  pips are represented, marked  $\epsilon_1$ ,  $\epsilon_2$ ,  $\epsilon_3$ , and  $\epsilon_4$ ,  
10           supplied during the first six recurrences.

          Each of the incident radials is written in in step with its arrival (at the PRF frequency) in one of the memories  $M_1$ - $M_3$ , starting, for example, with the memory  $M_1$  into which is written the last recurrence of the  
15           antenna rotation, marked  $\text{Rec}_N$ . The memory number being written to increments by one unit upon the first  $\text{SY}_R$  synchronization pip which follows the reception of an  $\epsilon$  pip. In practice, the  $\text{SY}_R$  synchronization pip separating the recurrences  $N$  and 1 ( $S_0$ ) being received just after an  
20            $\epsilon$  pip, in this instance the North signal, the number of the memory being written to increments by one unit and the first recurrence  $\text{Rec}_1$  is therefore written into the memory of  $M_2$ . In the same way, in the example represented, the pip  $\epsilon_1$  occurring just before the pip  $S_1$ ,  
25           the following recurrence  $\text{Rec}_2$ , is written into the following memory, that is to say  $M_3$ . Still in the example represented, the periodicity of the  $\epsilon$  pips is such that the pip  $\epsilon_2$  does not occur before but after the pip  $S_2$ . Consequently, the third recurrence  $\text{Rec}_3$  is assigned to  
30           the same memory as the recurrence  $\text{Rec}_2$ .

          Moreover, according to the invention, the information corresponding to the recurrence  $\text{Rec}_3$  does not erase the preceding content of the memory  $M_3$ , namely the recurrence  $\text{Rec}_2$ , but combines with the latter according  
35           to a grouping function, for example a maximum function; the contents of the memory  $M_3$  is then, for each quantum, the maximum value of the corresponding quanta of the recurrences  $\text{Rec}_2$  and  $\text{Rec}_3$ .

          The pip  $\epsilon_2$  occurring before the recurrence  $\text{Rec}_4$ ,

the latter is written into the next memory, that is to say the memory  $M_1$  (modulo 3), etc.

As far as reading is concerned, reading is carried out from one of the memories each time an  $\epsilon$  pip is received for constituting a radial; the number of the memory to be read is obtained by subtracting 1 (modulo 3) from the number of the memory which is being written to at the instant when the  $\epsilon$  pip is received. Upon reception of the North pip, the memory being written to in the case of Figure 3a is the memory  $M_1$ : the memory being read from is therefore the memory  $M_3$ .

At the pip  $\epsilon_1$ , which occurs while the memory  $M_2$  is being written to, the memory  $M_1$  becomes the memory read from.

At the pip  $\epsilon_2$ , the memory being written to being the memory  $M_3$ , the memory  $M_2$  becomes the memory being read from, which will then form the first radial of the rotation, marked  $\text{Rad}_1$ , etc.

Figure 3b is similar to Figure 3a except for the fact that, in this example, the frequency of the  $\epsilon$  pips is higher than the PRF frequency.

Four recurrences are therefore represented ( $\text{Rec}_1$ ,  $\text{Rec}_2$ ,  $\text{Rec}_3$ ,  $\text{Rec}_4$ ) and nine  $\epsilon$  pips ( $\epsilon_1 \dots \epsilon_9$ ). As before, the recurrences are written into memory in step with their arrival, the number of the memory being incremented by one unit for each synchronization pip which immediately follows an  $\epsilon$  pip.

In reading, the process is also as before. The frequency of the  $\epsilon$  pips being higher than that of the synchronization pips ( $\text{SY}_R$ ), it is seen that the same memory may be read several times in order to constitute different radials, that is to say radials separated by an  $\epsilon$  angle increment, but whose visual content will be identical: this is the case, for example, in the diagram of the first recurrence,  $\text{Rec}_1$ , written into memory  $M_2$ , and which will be read twice, on the pips  $\epsilon_4$  and  $\epsilon_5$ , to constitute the first two radials,  $\text{Rad}_1$  and  $\text{Rad}_2$ .

In Figure 3b there is moreover represented the particular case in which an  $\epsilon$  pip ( $\epsilon_3$ ) and an  $\text{SY}_R$  pip ( $S_1$ )

are simultaneous. A priority therefore has to be defined. It is chosen, for example, to consider the  $\epsilon$  pip as prior to the  $SY_R$  pip. In consequence, at this moment, reading carries on on the memory  $M_1$ .

5           It appears that the method according to the invention applies whatever the PRF/ $\epsilon$  pips frequency ratio: higher, lower or even equal to 1, and that even if the ratio varies. This constitutes an advantage, especially in the case in which this ratio being close to 1, it  
10       may become higher or lower than 1 in the course of normal operation of the radar, the antenna of the latter possibly having a movement which is not perfectly regular.

          Figure 4 represents the flow chart for a mode of generating the identifications (numbers) of memories  
15       being written to and being read from, as well as certain validation signals, in the method according to the invention.

          The flow chart begins with a certain number of initializations: step 40 in Figure 4. The address of the  
20       memory being written to is called E, it is initialized, for example, to 1. The address of the memory being read from is called L and it is initialized to 3 if the group of memories includes  $m=3$  memories. Initialization of two indicator bits, or flags, used later, is also carried  
25       out, an  $SY_R$  flag and an  $\epsilon$  flag, which are both initialized to 1.

          The following step, 41, is a test on the reception of an  $SY_R$  synchronization pip. In a following step, marked 42, the value of the  $SY_R$  flag is tested. If  
30       the latter is equal to 1 as is the case after the initialization, the following step (43) is reached, which consists in incrementing the value of the memory being written to by one unit (modulo 3), that is to say that the memory which is to receive the recurrence is the  
35       memory  $M_2$ . At the same time, a bit called ITR is positioned at the value 1, the use of which will be explained later, and the value of the  $SY_R$  flag is altered, becoming equal to 0. In a subsequent step 44, the  $\epsilon$  flag is positioned at the value 1 in the event that

it is not already so, the incident recurrence is written into the memory  $M_2$  and there is a loop-back to the test 41 for reception of an  $SY_R$  pip.

Referring to the diagram of Figure 3a, this is assumed now to be the instant of reception of the pip  $e_1$ ; the response to the test 41 is therefore negative and a test (45) then takes place on the reception of an  $e$  pip. In the present assumption, the response is yes and the value of the  $e$  flag is tested (step 46). If, as is the case here, it is equal to 1, a bit called VLE is positioned at the value 1 (step 47), the value of the  $e$  flag is changed to the value 0 and the number of the memory being read from (L) becomes equal to the number of the memory being written to (E) minus one unit (modulo 3). In a following step, marked 48, the  $SY_R$  flag is positioned at 1, the memory is read to constitute a radial and there is a loop-back to the test for reception of a synchronization pip. In the same way, if the response to the test (45) for an  $e$  pip is negative, there is a loop-back to the test (41) for an  $SY_R$  pip.

The bit ITR is used during writing a recurrence into a memory M. In the case in which it relates to a recurrence immediately following an  $e$  pip, for example  $Rec_2$  into memory  $M_3$  (Figure 3a), the recurrence has to be written while erasing the initial contents of the memory  $M_3$ . In contrast, upon writing a second recurrence ( $Rec_3$ ) into the same memory ( $M_3$ ), the content ( $Rec_2$ ) of the memory should not be erased but grouped together with the incident recurrence. The bit ITR serves to control the two operations corresponding to the two cases: for example, to inhibit the grouping function with  $ITR = 1$  in the first case and  $ITR = 0$  in the second case. The  $SY_R$  flag serves to distinguish the first recurrence following an  $e$  pip.

The bit VLE is used when it is desired to plot a radial whose video is nil. In fact, in certain conditions of use, it may be wished that the image displayed by means of the DIC rather resembles an image of the type of those which are obtained on a screen of the PPI type (for

Plan Position Indicator). It is then preferable not to carry out recopying of the same recurrence to constitute several radials as illustrated in Figure 3b. The VLE bit is then used in a way analogous to the ITR bit, to  
5 identify the first radial which follows an  $SY_R$  pip, which alone will be displayed, the following being forced to the value 0.

Figure 5 represents an embodiment of the means for implementing the method according to the invention.

10 The device of Figure 5 thus includes, for example, three memories  $M_1$ ,  $M_2$  and  $M_3$ , preceded on the path of the incident recurrences by a grouping circuit 51, which receives the latter in digital form. The device further includes: a write addresses generator 52; a read  
15 addresses generator 53; a sequencer 54 supplying the memory numbers according to the operation described previously in Figure 4; a circuit 55 for managing the modes of operation of the memories  $M_1 - M_3$ ; a circuit 56 for generating the angle  $\theta$  from the  $e$  pips, and, if  
20 appropriate, a read processing device 57. This device further comprises selection devices 58, 59 and 60.

The device operates in the following way.

For writing a recurrence into memory:

25 An incident recurrence is written into one of the memories, for example  $M_1$ , possibly after grouping together (circuit 51) with the preceding content of the memory  $M_1$ . The grouping is controlled by the ITR bit supplied by the sequencer 54. The memory  $M_1$ , (like the memories  $M_2$  and  $M_3$ ) is linked to the grouping circuit 51  
30 by the selection circuit 58, itself linked by a bus to the circuit 51. The selection circuit 58 is linked by three buses to the three memories  $M_1 - M_3$  and performs the routing of the incident recurrences as a function of the number ( $E$ ) of the memory in which writing is to be done;  
35 the number  $E$  is supplied to the selection circuit 58 by the sequencer 54.

The address at which the information supplied to the memory  $M_1$  is to be written is given by the write address generator 52, which consists, for example, of a

counter, receiving the rate  $H_0$  of the quanta forming the recurrence. The generator 52 is reset to zero by the  $SY_R$  pips, that is to say on each recurrence. This address is transmitted to the memory  $M_1$  via the selector 6 which, linked to the three memories  $M_1 - M_3$ , receives the number (E) of the memory being written to and routes the address as a consequence, in a manner analogous to the selector 58.

Finally, the control of the writing mode (W) of the memory  $M_1$  is done by the chronometry device 55 providing the management of the modes of the three memories  $M_1 - M_3$ , on receipt of the memory numbers E and L.

For reading from a memory:

One of the memories, for example  $M_3$ , is read on reception of an  $\epsilon$  pip in order to constitute a radial. The latter is possibly forced to a zero value by the circuit 57 under the command of the VLE bit. The memory  $M_3$ , like the memories  $M_1$  and  $M_2$ , is linked to an output bus for the video, to the circuit 57, by means of the selection circuit 59. The latter is, in a manner analogous to the selector 58 but for reading, linked to each of the memories  $M_1 - M_3$  and performs routing under the control of the number (L) of the memory being read from, supplied by the sequencer 54.

In a way analogous to what has been described for the write phase, the read address generator 53 supplies the addresses to the memory  $M_3$  at the rate  $H_{DRC}$  at which the quanta must be supplied to the downstream DIC processing; the generator 53 is reset to zero by each  $\epsilon$  pip; the address which it supplies is routed by the selector 60. The read mode (R) is controlled in the memory  $M_3$  by the chronometry circuit 55.

It should be noted that the sequencer 54, due to the asynchronism in the various signals, has to operate at frequency  $H_s$  which must be the least common multiple of the clocks  $H_0$ ,  $H_e$  and  $H_{DRC}$ .

Finally, to be complete, the device of Figure 5 further includes the circuit 56 for generation of the angle  $\theta$  associated with the radial supplied, which is a

counter receiving the  $\epsilon$  pips and reset to zero by the North pip. The circuit 56 may furthermore provide a correction for the time shift which is observed, for example, in Figure 3a, where the radial ( $Rad_1$ ) corresponding to the first recurrence ( $Rec_1$ ) written after the North pip will be read after several  $\epsilon$  pip (sic) (at pip  $\epsilon_2$  in this example).

The method described above, assigning radar recurrences to visually displayable radials, may be used to carry out a homogenization function by filling of the visually displayed image.

It is recalled that, in a DIC, the process of conversion and of visual display is quantified and it transpires that this gives a "moth-eaten" look to the image. It is therefore desirable to homogenize the image in this respect by "filling" the holes, that is to say by assigning them a luminosity as a function of the surroundings. This process of correction of defects is known by the name of "pixel filling" in the literature.

In the context of a DIC, a known solution consists in attributing to the pixels which are not addressed by the conversion, and are therefore dark, a luminosity value which is a function of that of the adjacent pixels, for example that of the eight pixels which surround the pixel in question. This solution rapidly comes up against limits, especially related to complexity and to cost, when the processing speeds have to be high as is often the case for a radar.

Another solution is described in the French Patent Application 86 00321, which consists in carrying out this filling no longer at the level of the pixels of the image memory, but at the level of the signal received in polar coordinates (modulus  $\rho$ , polar angle  $\theta$ ). The method then consists in creating dummy radials between the real radials and in assigning a video signal to each of them, as a function of the video signal of the adjacent real radials; more precisely, it is a function of the value of the adjacent video signals which are situated at the same value of the modulus  $\rho$ .

When the assigning of the recurrences to the radials is carried out as previously described, it is possible furthermore to carry out the homogenization function by adding to the device a fourth memory M, so as to make use simultaneously of two memories in read mode instead of only one. In that way, it is possible to create a supplementary dummy radial from the two radials which are read simultaneously.

With respect to the progression of the method described above, the determination of the memory number being written to remains the same, but modulo 4. The determination of the numbers ( $L_1$ ,  $L_2$ ) of the two memories being read becomes:

$$\begin{aligned} L_1 &= E - 1 \text{ (modulo 4)} \\ L_2 &= E - 2 \text{ (modulo 4)} \end{aligned}$$

This makes it possible to carry out filling of degree 1, that is to say corresponding to the creation of a dummy radial between two real radials.

It is also possible to carry out a filling of higher degree (P), that is to say corresponding to the creation of several (P) dummy radials between two real radials. The dummy radials may then be sent in parallel or in series. In the case where they are sent in series, the transmission of a real quantum is then accompanied simply by transmission of P quanta, characterized by the same modulus  $\rho$ , but belonging to the P dummy filling radials.

Figure 6 represents the block diagram of a DIC implementing the method according to the invention.

A DIC may be broken down into a few subassemblies:

- a subassembly 1 forming an input interface and receiving the signals supplied by the radar receiver;
- a subassembly 2, carrying out the conversion of the polar coordinates into cartesian coordinates;
- a memory and remanence subassembly 3, in which the radar information is recorded in the format in which it will be displayed, in television mode, by a device 4.

The function of the interface 1 is mainly the

sampling of the radar video signal and its digitization (circuit 10), possibly some brief processing on this video signal (circuit 11), as well as the memory storage of this information and the assigning of the recurrences to the visually displayable radials: it is a circuit 12, constituted, for example, as illustrated in Figure 5. The radials thus constituted and stored in memory are supplied to the memory assembly 3 via the coordinate conversion subassembly 2, which allows calculation of the address in memory of each of the points of the radials.

These various subassemblies are controlled and initialized by a processor 5.

CLAIMS

1. Method of assigning the received recurrences, corresponding to the video signals received in response to the pulses transmitted by a radar, to visually displayable radials, the recurrences being supplied at a first frequency which is the repetition frequency (PRF) of the radar and accompanied by a first synchronization signal ( $SY_R$ ) constituted by a first series of pips at the first frequency, and the radials being supplied at a second frequency in synchronism with a second synchronization signal ( $\epsilon$ ) constituted by a second series of pips at the second frequency;  
the method being characterized in that it includes the following steps:
- memory storage of the recurrences at their arrival rate by writing, in one of the memories of a group of  $m$  memories, with  $m \geq 3$ , the identification of the memory written to being changed on reception of the first pip ( $SY_R$ ) of the first series following a pip ( $\epsilon$ ) of the second series;
  - grouping together a received recurrence with the previously received and already stored recurrence, in the case where the said memory identification has not changed;
  - reading of at least one memory of the said group in order to constitute a radial, on reception of each pip ( $\epsilon$ ) of the second series, the identification of the memory read from being obtained from that of the memory written to at the same moment.
2. Method according to Claim 1, characterized in that the second frequency ( $\epsilon$ ) is supplied by the rotation angle increment signals from the radar antenna.
3. Method according to one of the preceding claims, characterized in that a recurrence is constituted by a series of digital information called quanta, that the said grouping consists in comparing the quanta of the same rank of the two recurrences and in storing the quantum whose value is the highest.



4. Method according to one of the preceding claims, characterized in that the memories are numbered from 1 to  $m$ , that the identification of the memory written to is constituted by its number and that this number is incremented by one unit on reception of each pip ( $SY_R$ ) of the first series following a pip ( $e$ ) of the second series, modulo  $m$ .

5. Method according to Claim 4, characterized in that the identification of the memory read from is constituted by its number and that this number is obtained by subtracting one unit from the number of the memory written to at the same moment, modulo  $m$ .

6. Method according to one of the preceding claims, characterized in that the group of memories includes three memories.

7. Method according to Claim 4, characterized in that the group of memories includes four memories, two of them being simultaneously read from, their identification being constituted by their number, the latter being obtained by subtracting respectively one and two units from the number of the memory written to at this moment, modulo 4, the two radials thus obtained making it possible to form a synthetic filling radial.

8. Digital image converter, receiving radar recurrences and supplying visually displayable radials in television mode, including:

- interface means, receiving the radar recurrences, expressed in polar coordinates;

- means of conversion of the polar coordinates into cartesian coordinates;

- memory and remanence means;

the converter being characterized in that the interface means include, for implementing the method according to one of the preceding claims:

- a group of  $m$  memories ( $M_1, M_2, M_3$ ), with  $m \geq 3$ , receiving the recurrences;

- an address generator (52) for writing into the memories;

- an addresses generator (53) for reading from





the memories;

- a sequencer (54) supplying the identification in writing or in reading;

- grouping means (51), arranged on the route of

5 the recurrences received upstream from the group of memories and carrying out grouping of a received recurrence with a previously received and already stored recurrence, in the case where the said memory identification has not changed.