OPTIMIZING PROGRESSIVE AND COMPOSITE SAMPLING FOR DIGITAL TERRAIN MODEL

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ABSTRACT

The purpose of this study was to optimize Composite Sampling by tuning the algorithms and parameter values to attain a comprehensive, sufficiently accurate and conditioned DTM, with a minimum of effort.

The investigation addresses two main issues. The first is to study the effects of different decision models for the adaptive grid densification in Progressive Sampling. The second concerns the performance of Composite Sampling and Progressive Sampling when applied to representative geometric primitives.
The investigation has led to better understanding and thus to improved insight into the different effects of sampling. The knowledge gained provides feedback for optimization of the sampling procedure.

I INTRODUCTION

A Digital Terrain Model (DTM) system, which can be part of abroader information system, includes the concepts, models, methods and means for collection, processing, and presentation of the terrain relief information.

The purpose of this study was optimization of the Composite Sampling (CS) methods for DTM. To this end the following main objectives should be met:
1) To establish the rules and procedures for effective Selective Sampling (SS) in the context of CS.
2) To study the effects of the different decision models for adaptive grid densification in Progressive Sampling (PS) to identify the best one.

To meet these objectives, the following approach was used:
1) Formulate the potential criteria for local grid densification and their testing on representative local shapes of terrain relief.
2) Investigate PS and variants of CS by using some ideal geometric primitives as the input. Subsequently, some rules for Selective Sampling should be identified and then applied to CS of real terrain for verification and further improvements.

The scope of this paper is to review a more extesive, in-depth study and opimization of CS. The main issue of this study has been Selective Sampling in the context of Composite Sampling. Attention was also given to the effects of the different criteria for adaptive grid densification in Progressive Sampling.

II SELECTIVE SAMPLING

1 General

SS is carried out manually to portray and /or isolate and exclude the anomalous regions in terrain. It is applied to abrupt changes in terrain slope, peripheries of water surfaces, clouds and image areas with a poor stereoscopic hold, etc. Basically, SS is a subjective method of portraying the skeleton of terrain relief and of isolating the anomalous regions.

The output of SS represents the Σ-set, which comprises peripheral lines, break lines and break points, auxiliary lines and auxiliary points, and some descriptors. This information serves as the input for the subsequent PS.
The Σ-set can be classified according to :
- Feature genetics (natural, man-made).
- Feature type:
  - .Lines:
    - Break-lines(ridge, drainage, convex and concave),
    - Auxiliary lines(maxima, minima, others),
    - Peripheral lines(water, clouds, other).
  - .Points:
    - Break-points(peak, pit, pass, convex, concave),
    - Auxiliary points(peak, pit, pass, convex, concave).

These features can be extracted and sampled from stereo-images.

2 Segmentation and structuring

The distinct features inside the unsmooth regions should be identified, segmented, and structured hierarchically. A consistent segmentation and structuring of the terrain relief provides for orderly feature extraction and sampling, and it reduces omissions. The extraction and segmentation are interrelated; the corresponding procedure comprises a number of rules.

3 Feature extraction

For the extraction of significant features in terrain relief, a set of rules can be established and then applied in a logical sequence. In the following a list of rules for the extraction is presented:
-first regions then networks,
-first larger entities then smaller entities,
-from north west to south east,
-first right branches then left branches,
-from inside to outside,
-consistent sequence (clockwise) in extracting branches and isolated features.
These rules together form a part of the rule base for SS.

4 Sampling

Sampling concerns measurement of the extracted and structured terrain relief features. The rules established for the extraction are also applicable to sampling. Sometimes extraction and sampling are carried out in parallel.
Sampling is applied to the extracted peripheral lines, the brak-lines and points, and to the auxiliary lines and points.

a) Peripheral lines

The peripheral lines of regions should either be closed or connected to the model boundaries. These lines need not be accurately defined unless they coincide with the distinct break lines or with other significant line features in terrain.

b) Break lines and points

Any abrupt change in terrain slope represents a break line or a break point. A break line is regarded as a string of break points. To define a measure for a break point, we consider a triplet of points (i-1,i,i+1) perpendicular to the break line (figure 1).

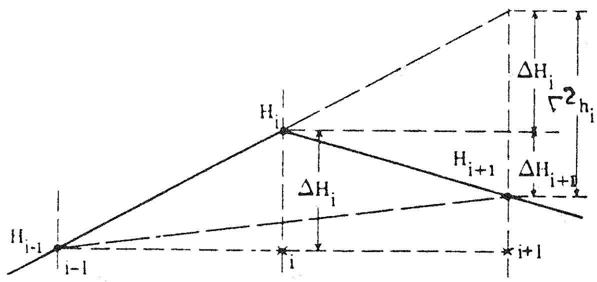

Fig. 1 Definition of a break point

Point i is considered as the break point if the second difference in height $\nabla^2 H_i = H_{i+1} - 2H_i + H_{i-1}$ exceeds a specified threshold [2].

A quantification of $\nabla^2 H$ is useful only in doubtful situations.

c) Auxiliary lines and points

In addition to the distinct break lines and/or points some auxiliary lines and/or points should also be sampled. These may represent less distinct transitions in slope and/or connect the distinct points with the nearest sampled lines, to portray the skeleton of the terrain relief faithfully.

If the auxiliary lines were not sampled in relatively smooth terrain with few local extremes, pseudo lines connecting such locally extreme points with the nearest sampled lines can be generated by a computer subroutine. These pseudo lines are then actively involved in the CS. After completion of CS the pseudo lines are removed from the DTM.

III PROGRESSIVE SAMPLING

1) General

PS is a semi-manual method for sampling regions of mainly homogenous terrain relief, thus providing the filling information. The density of the DTM grid is locally adapted to terrain roughness. PS in combination with SS results in CS.

2) Different densification criteria
The core of PS is the criterion for local grid densification. Hence, the corresponding criteria and decision rules are most significant.

In [2] a one dimentional (1D) Laplacian operator was used separately in the X and Y directions. The following criteria are potential alternatives:

. 2D-Laplacian,
. Extended 2D-Laplacian,
. 1D-Laplacian in four directions,
. Median height,
. Fitted plane,
. Second difference for a quadruple of points, separately in the X and Y directions.

In the following, consideration is given only to criteria 1,2 and 3, though the other criteria were also tested.

2.1 2D-Laplacian
After each sampling run, the already-sampled incomplete DTM grid is convolved with the following filter:

$$\begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

Thus $\hat{h}_1 = \sum_1^4 h_{dn} - 4h_{mid}$,
where dn indicates the direct neighbours, and mid indicates the midpoint.
To detect the local non-linearariarities in terrain, the filtered values $\hat{h}_i$ are thresholded. A computer subroutine accordingly decides upon the further densification of the DTM grid.

If $|\hat{h}_1| > Th$ then: densify,
else: go to next point,
where Th is a specified threshold.

2.2 Extended Laplacian
The filter is defined by the following kernel:

$$\begin{bmatrix} 1 & 1 & 1 \\ 1 & -8 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

Thus $\hat{h}_2 = \sum_1^8 h_{peripheral} - 8 * h_{mid}$

If $|\hat{h}_2| > Th$ then: densify,
else: go to next point.

2.3 1-D Laplacian in four directions

The filter is defined by:

[1 -2 1]

It is applied separately in X,Y and both diagonal directions.

The second differences are thus computed for the triplets of points in all directions centered in the mid-point. All of these differences are then compared against the threshold.

If $\hat{h}_{4x} > Th$ or $\hat{h}_{4y} > Th$ or $\hat{h}_{4xy} > Th$ or $\hat{h}_{4yx} > Th$

then: densify,
else: go to next point.

3. Tests

3.1 Conduct (input)

The aim of the tests was to study experimentally the feasibility of the different densification criteria for PS. To this end, an artificial surface was used as input instead of real terrain relief. The surface was a composite of ideal geometric primitives (figure 9). The height of the peak of the composite surface is H max. PS was applied with different threshold values Th.
For the study, the following densification criteria were used:

.VARIANT-1, PS(1); using 1D-Laplacian algorithm separately in X and Y
.VARIANT-2, PS(2); using 2D-Laplacian algorithm
.VARIANT-3, PS(3); using extended 2D-Laplacian algorithm
.VARIANT-4, PS(4); using 1D-Laplacian algorithm separately in four directions.

3.2 Measures for assessment (output)

The following measures were used for the assessment of the test results:
The mean error σ_{PS} of PS was calculated for the grid points on the composite surface:

$$\sigma_{PS} = \sqrt{(\Sigma V_{\pi}^{2} / N_{\pi})},$$

where V_{π} is the error of sampling and interpolation on the surface affected by PS, and N_{π} is the number of points affected by PS.

For comparison with other tests, the mean error was normalised with respect to H max:

$$\overline{\sigma}_{PS} = \sigma_{PS} / H\ max$$

The discrepencies V, however, are not random, which implies that their distribution is not normal.

The maximum discrepancy between the generated ideal and the interpolated surface (in each test) was also normalised by H max:

$MA\bar{X}ER$ = maximum discrepancy / H max.
A measure for the efficiency is the number of sampled points per unit area. Thus a suitable criterion for the comparison with other tests is the ratio:
E = [number of sampled points] / [total number of points]

For a comparative assessment the following relative differences in performances are suitable:

$\Delta\bar{\sigma}$ = increase or reduction of the mean error $\bar{\sigma}$;

Δ $MA\bar{X}ER$ = increase or reduction of the maximum error MAXER;
$\Delta E = E_{variant} - E_{reference}$, i.e., increase or decrease of efficiency.

3.3 Test results
In the following, results are reviewed of the tests applied to the composite surface only. Hence they are not generally representative.

CRITERION	Th/H max	VARIANT	σ	MAXER	E
1D LAPLACIAN in X and Y	1/6	PS(1)	0.89 %	3.24 %	19 %
	1/12		0.40 %	1.90 %	42 %
	1/24		0.16 %	1.47 %	77 %
2D LAPLACIAN	1/6	PS(2)	2.83 %	11.34 %	11 %
	1/12		0.79 %	3.96 %	25 %
	1/24		0.22 %	2.12 %	62 %
EXTENDED 2D LAPLACIAN	1/6	PS(3)	1.16 %	6.55 %	19 %
	1/12		0.40 %	2.12 %	40 %
	1/24		0.01 %	0.95 %	81 %
1D LAPLACIAN IN FOUR DIRECTIONS	1/6	PS(4)	0.51 %	2.58 %	33 %
	1/12		0.14 %	1.29 %	71 %
	1/24		0.01 %	0.95 %	88 %

Table 1: Performance measures

COMPARISON	Th/Hmax	$\Delta \bar{\sigma}$	$\Delta \overline{MAXER}$	Δ E	COMMENT
PS(2) vs PS(1)	1/6	+1.96 %	+8.10 %	+8 %	substantial gain with decreasing threshold
	1/12	+0.39 %	+2.06 %	+17 %	
	1/24	+0.06 %	+0.65 %	+15 %	
PS(3) vs PS(1)	1/6	+0.27 %	+3.31 %	0	slight gain at max. threshold
	1/12	0.00	+0.22 %	+2 %	
	1/24	-0.15 %	-0.52 %	-4 %	
PS(4) vs PS(1)	1/6	-0.38 %	-0.66 %	+14 %	slight gain with decreasing threshold
	1/12	-0.26 %	-0.61 %	-29 %	
	1/24	-0.15 %	-0.52 %	-11 %	

Table 2: Relative differences in performance

3.4 Conclusion

From the results for the composite artificial surface, it follows that for larger values of the threshold (1/12 ≤Th/H max ≤ 1/6) the "1D-Laplacian in four directions" performs better than the other criteria tested.

For smaller thresholds, however, both "the extended 2D-Laplacian" and "1D-Laplacian in four directions" provide better accuracy at the expense of reduced efficiency.

IV COMPOSITE SAMPLING

1) General

CS combines Selective Sampling (Σ-set) with Progressive Sampling (Π-set). The aim is to portray terrain relief faithfully without excessive redundancy of the sampled information.

The four main stages of Composite Sampling are shown in figure 2.

| SELECTIVE EXTRACTION AND SEGMENTATION |

↓

| SELECTIVE SAMPLING |

↓

| MAPING Σ-SET INTO GRID DOMAIN
AND
PARTITIONING Σ-SET INTO PATCHES |

↓

| PROGRESSIVE SAMPLING |

Fig. 2 Main stages of Composite Sampling

The input is photographs of the terrain and the corresponding control data. The specified DTM grid is partitioned into square patches which act as the working units.
The output of CS is an incomplete regular DTM grid with density adapted to local terrain roughness, supplemented with the skeleton information (Σ-set). The original selectively sampled Σ-set is preserved in the data base.
In CS, the Σ-set is first mapped into the grid, and then itis used in the Progressive Sampling; the latter providing the Π-set.
After each sampling run in PS, all information in the grid is analysed in conjunction with the decision rules for the further densification.
The two sets Σ and Π are therefore supplementary, whereby Π depends on Σ.
The core of the optimization is thus to attain the balance between Selective and Progressive Sampling.
In this context ,however, the following questions arise :
-How comprehensive and how accurate should the Σ-set be ?
-How should Σ-set be structured ?
-Which strategy and rules should be applied for the selective extraction and sampling ?

To answer these questions, we should study first the effects of the different sub-sets of Σ in CS.

2) Tests
2.1 Conduct (input)
The aim of the tests is to study the feasibility of the variants of CS when applied to ideal geometric primitives, their composite, and real terrain relief.

For the tests, the following Σ-subsets were used:
.$\Sigma 1$: peripheral lines and break lines,
.$\Sigma 2$: peak or pit,
.$\Sigma 3$: pseudo-break lines.
These subsets were used in modelling the composite artificial surface in the following combinations:
Input : composite of the primitives (COMPRI)
set-1 : COMPRI U $\Sigma 1$,
set-2 : COMPRI U $\Sigma 1$ U $\Sigma 2$,
set-3 : COMPRI U $\Sigma 1$ U $\Sigma 2$ U $\Sigma 3$,
Composite Sampling was carried out in four variants:
.VARIANT-1 : PS = Progressive Sampling only, using COMPRI,
.VARIANT-2 : CS(1) = Composite Sampling , using set-1,
.VARIANT-3 : CS(2) = Composite Sampling , using set-2,
.VARIANT-4 : CS(3) = Composite Sampling , using set-3.

2.2 Measures for assessment (output)
The following measures have been used for the assessment of the test results:
- The mean error σ_{PS} of PS is determined for the grid points on the surface of the primitive itself and on its outskirts which are affected by sampling:

$$\sigma_{PS} = \sqrt{(\Sigma V_{\Pi}^2 / N_{\Pi})}$$

For the purpose of comparison with other tests, the mean error is normalised with respect to H max;

$$\bar{\sigma}_{PS} = \sigma_{PS} / H\ max$$

- The mean error σ_{CS1} of CS, for comparison with σ_{PS}, is estimated for the same sample size (N_{Π}) in both.

Outside that area, there are no discrepencies.

$$\sigma_{CS1} = \sqrt{(\Sigma V_{\Sigma}^{2} / N_{\Pi})}$$

where V_{Σ} are the discrepencies between the interpolated and the ideal surface.
This mean error can also be normalised by H max

$$\bar{\sigma}_{CS1} = \sigma_{CS1} / H\ max$$

- The actual mean error σ_{CS2} for CS is estimated only for the grid points on the artificial surface itself; this is because there are no errors in the outskirts.
Hence,

$$\sigma_{CS2} = \sqrt{(\Sigma V_{\Sigma}^{2} / N_{\Sigma})}$$

where N_{Σ} is the number of points on the artificial surface.
The total number of points in the patch N_T = 33*33.

The mean error was also normalised by H max

$$\bar{\sigma}_{CS2} = \sigma_{CS2} / H\ max$$

-The maximum discrepancy in each experiment between the ideal and the interpolated DTM surface is normalised by H max:

$\overline{MAXER}$ = maximum discrepancy / H max

-The efficiency is defined by the number of sampled points per unit area:
E = [number of sampled points] / [total number of points]

For comparative assessment, the relative differences in performance are suitable:

$\Delta \bar{\sigma}$ = increase or reduction of the mean error $\bar{\sigma}$;

Δ $\overline{MAXER}$ = increase or reduction of the maximum error;
Δ E = increase or decrease of efficiency.

2.3 Tests results

The four variants of CS were applied to the selected ideal geometric primitives (figures 3 to 7), their composite (figure 8) and to real terrain (not included here). For each test, three different threshold values were used.

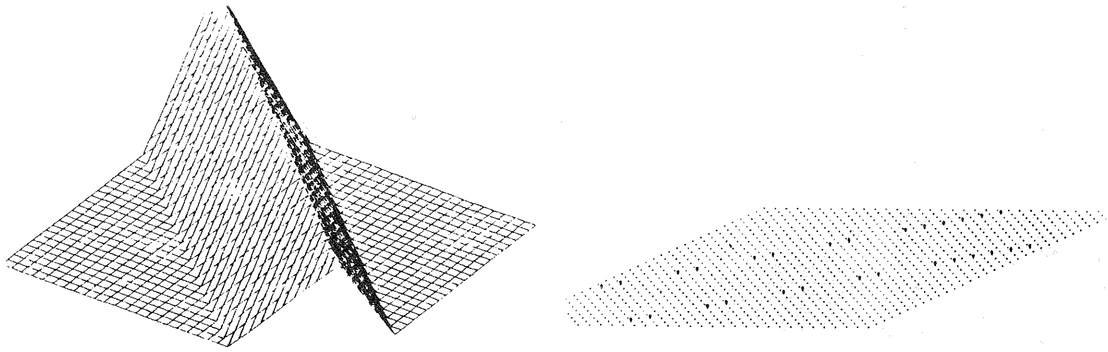

Fig. 3 Roof with the error pattern (for CS, Th = 1/3)

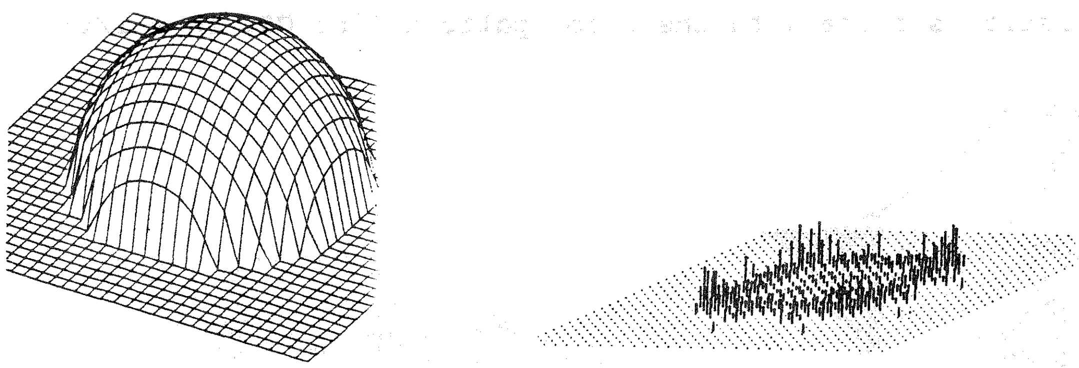

Fig. 4 Spheroid with the error pattern (for CS, Th = 1/4)

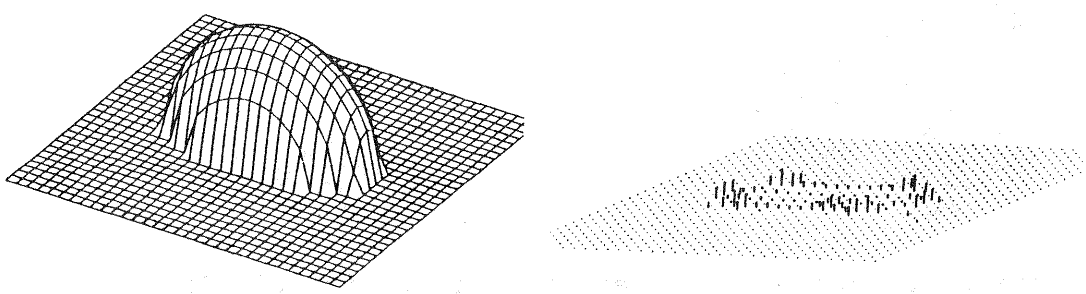

Fig. 5 Ellipsoid with the error pattern (for CS, Th = 1/3)

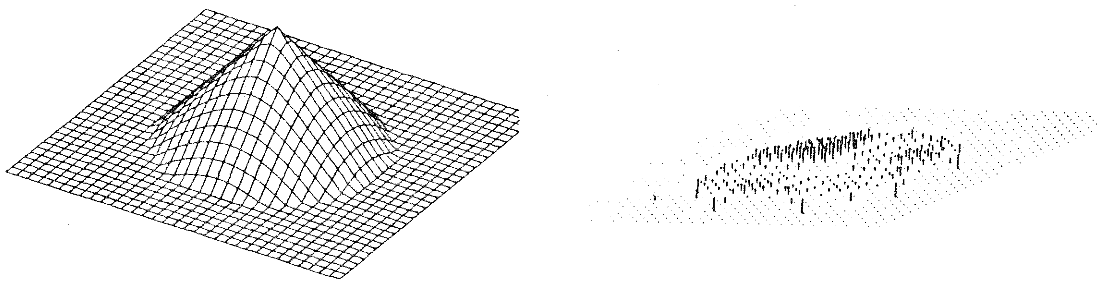

Fig. 6 Cone with the error pattern (for CS, Th = 1/5)

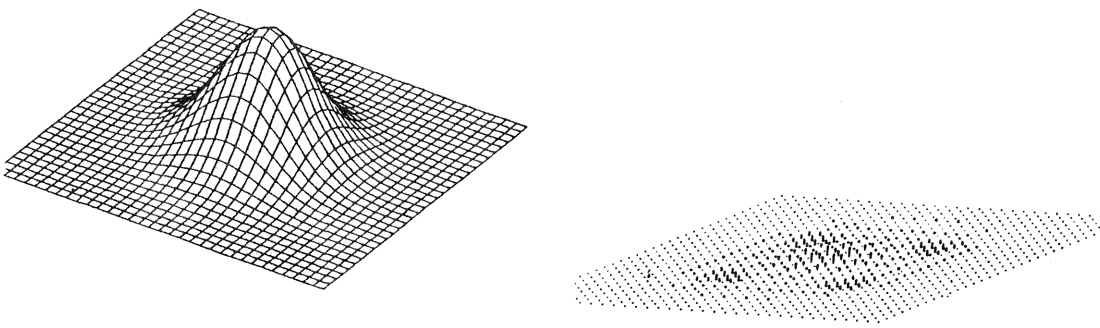

Fig.7 Gaussian surface with the error pattern (for CS, Th = 1/4)

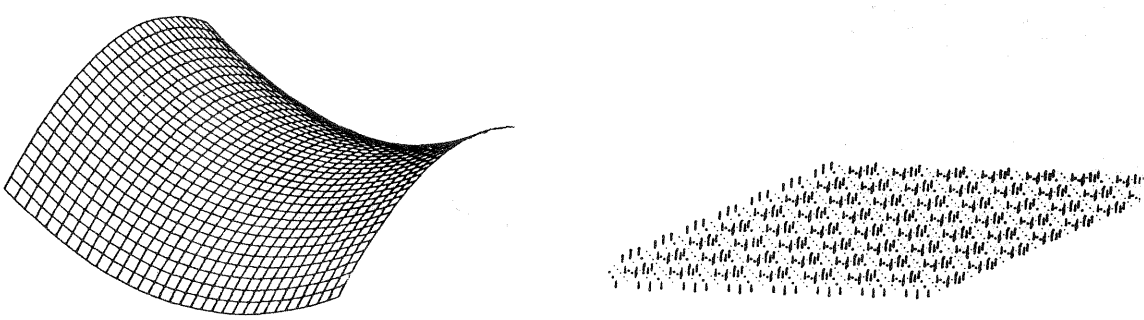

Fig.8 Saddle with the error pattern (for CS, Th = 1/12)

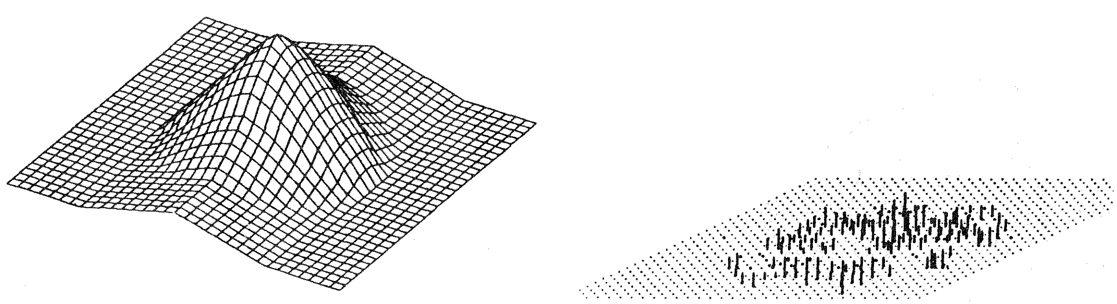

Fig.9 Composite surface with the error pattern (for CS, Th = 1/12)

Some results of CS variants 2 and 3, applied to the composite artificial surface, are summarised in tables 3 and 4. These tables contain the relative differences in performance and efficiency between the pairs of the variants CS(3) and PS, and CS(3) and CS(2).

Test	Th/H max	Δ $\overline{\sigma}$	Δ $\overline{MAXER}$	Δ E
CS(3)	1/6	0.28 %	2.55 %	4 %
vs	1/12	0.05 %	0.00 %	6 %
PS	1/24	0.10 %	0.42 %	13 %

Table 3: Differences in performance of CS(3) with respect to PS

Test	Th/H max	Δ $\overline{\sigma}$	Δ $\overline{MAXER}$	Δ E
CS(3)	1/6	0.19 %	2.45 %	1 %
vs	1/12	0.03 %	0.00 %	3 %
CS(2)	1/24	0.07 %	0.42 %	5 %

Table 4: Differences in performance of CS(3) with respect to CS(2)

2.4 Conclusions

From tables 3 and 4, valid for the composite artificial surface and the specific lay-out of the DTM grid, serveral conclusions can be drawn.

By comparing the results of CS(3) with those of PS (table 3), the following can be observed:

From table 3, containing the performance estimates for the average shift and rotation of the composite surface with respect to DTM grid, it is apparent that a larger threshold in CS(3) improves slightly the accuracy and decreases the effort. By using a small threshold value in CS(3), accuracy is improved but the effort is also increased.

The reliability of the DTM was estimated by the ratio of the number of correct points against the total number of sampled points.

When using the peripheral and break lines, including the peak of the surface, the reliability is 100 %.

The gains in performance of CS(3) with respect to CS(2) for the average shift and rotation of the primitive with respect to DTM grid are summarised in table 4.

By comparing the results of CS(3) (using the set-3) with those of CS(2) (using the set-2), the following observations can be made:

By decreasing the threshold, a significant gain in accuracy is attained at the expense of a minor loss in efficiency.

When using merely pseudo lines in CS, the reliability is 100%.

No gross errors occurred when using the VARIANT-3 [CS(2)] instead of the VARIANT-4 [CS(3)].

Tests were also carried out by including the peak (H max) in the Σ-set.
By comparing the result of CS(2) (using the set-2) with the results of CS(1)(using the set-1), the following observation was made:
For different values of the threshold the performance is the same in both sampling variants. Thus an isolated peak (without auxiliary or pseudo lines) does not improve the performance.
For the average shift and rotation of the composite surface with respect to DTM grid, the difference in performance of CS(2) with respect to CS(1) is negligible for all values of the threshold used.
The above conclusions are also valid for a wider range of the threshold, i.e., extended on both sides, Th/H max > 1/6 and Th/H max < 1/24.

Despite the fact that the conclusions drawn from these tests are not generally representative, it is apparent that break lines, auxiliary lines and peripheral lines should be sampled to a sufficient extent.
Distinct discrete points (peaks,pits,etc) should be connected with the nearest lines rather than left isolated. The pseudo lines slightly improve CS, but usually do not replace the auxiliary lines.

V RULES FOR SAMPLING

Selective Sampling of distinct morphometric features is essential for both the accuracy and efficiency of Composite Sampling.
Because SS is subjective, it needs to be systematised. To attain a balance between SS and PS and a smooth operation, some rules have been formulated. These represent a part of the RULE BASE for SS and CS.

1) Rules for Selective Sampling

From the tests, the following rules have been extracted for Selective Sampling (as integral part of Composite Sampling):

1.1 Rules for SS of the terrain features approximating the geometric primitives when auxiliary lines are included :

Terrain Feature	If H ≥ max	and Th/H ≥ max	Then	Else
Spherical surface	2.0 % Z	1/10	1	3
Ellipsoidal surface	1.5 % Z	1/7	1	3
Gaussian surface	2.0 % Z	1/5	1	3
Conical surface	2.4 % Z	1/12	1	3
Hyperbolic Paraboloidal surface	6.0 % Z	1/6	1	3
Composite surface	5.0 % Z	1/30	1	3
Break line	2.0 % Z	1/8	1	3
Fault	2.0 % Z	1/3	1	3

1.2 Rules for SS of the terrain features approximating the geometric primitives when auxiliary lines are not included :

Terrain Feature	If H ≥ max	and Th/H ≥ max	Then	Else
Spherical surface	2.0 % Z	1/7	2	3
Ellipsoidal surface	1.5 % Z	1/7	2	3
Gaussian surface	2.0 % Z	1/10	2	3
Conical surface	2.4 % Z	1/10	2	3
Hyperbolic Paraboloidal surface	6.0 % Z	1/6	2	3
Composite surface	5.0 % Z	1/30	2	3

Where
1= sample peak or pit(convex or concave)points and auxiliary lines,
2= generate pseudo-lines ,
3= no SS and proceed to next working unit.

2) Rules for Composite Sampling
These rules pertain to each triplet of points in the X and Y directions of the DTM grid. Inside a triplet J-P,J,J+P (or I-P,I,I+P) a search is made in each of the four half intervals for the presence of the s points (Σ-set mapped in the DTM grid; figure 3).

```
                            → |half interval|←
                              |             |
|     \s1          \s2        |     \s3     |     \s4    |
*-------|-------o-------|-------*-------|-------o-------|-------*
|        \   midpoint   \     |        \    midpoint   \     |
J-P                           J                             J+P
```

Fig. 3 Triplet of grid points with break points s

The corresponding rules for CS are:

```
if          no s point                              then
if midpt    is s point              go to the       next triplet
else if pt J-P is not sampled
     or pt J   is not sampled
     or pt J+P is not sampled        go to the       next triplet
         2
else if ∇ H > Th                     then
     if 1st triplet
     or no previous triplet          then
left densification       and         right densification
else
                                     right densification
```

```
if  s1 is present                       then
triplet is           s1   J  J+P
if pt J+P is not sampled
or pt J   is not sampled                then
left densification
         2
else if ∇ H > Th                        then
left densification     and             right densification
----------------------------------------------------------
if  s4 is present                       then
triplet is           J-P   J  s4
if pt J-P is not sampled
or pt J   is not sampled                then
         2                              right densification
else if ∇ H > Th                        then
left densification     and             right densification
----------------------------------------------------------
if  s1 and s4 is present                then
triplet is           s1   J  s4
if pt J  is not sampled                 then
         2                              right densification
else if ∇ H > Th                        then
left densification     and             right densification
----------------------------------------------------------
if  s2 is present                       then
if this is the 1 st triplet             then
left densification
else                       go to the next triplet
----------------------------------------------------------
if  s3 is present                       then
if this is the last triplet             then
                                        right densification
else                       go to the next triplet
----------------------------------------------------------
if  s2 and s3 are present               then
if this is the 1 st triplet             then
left densification
if this is the last triplet             then
                                        right densification
else                       go to the next triplet
----------------------------------------------------------
if  s1 and s2 are present               then
left densification
----------------------------------------------------------
if  s3 and s4 are present               then
if this is the last triplet             then
                                        right densification
else                       go to the next triplet
----------------------------------------------------------
if  s1 and s2 and S3 are present               then
if this is the last triplet             then
left densification     and             right densification
else
left densification
----------------------------------------------------------
```

```
if  s1 and s2 and s3 and s4  are present        then
if this is the last triplet      then
left densification      and      right densification
else
left densification
--------------------------------------------------------
if  s1 and s3 are present        then
if this is the last triplet      then
left densification      and      right densification
else
left densification
--------------------------------------------------------
if  s2 and s4 are present        then
if this is the 1 st triplet      then
left densification      and      right densification
else
                                 right densification
--------------------------------------------------------
if  s2 and s3 and s4 are present        then
if this is the 1 st triplet      then
left densification
if this is the last triplet      then
                                 right densification
else
go to the next triplet
--------------------------------------------------------
if  s1 and s3 and s4 are present        then
if this is the last triplet      then
left densification      and      right densification
else
left densification
```

where
in the X direction
right densification = densification in the interval J,J+P,
left densification = densification in the interval J-P,J.
in the Y direction
left densification = densification in the upper interval,
right densification = densification in the lower interval.
densification = assignment of six adjacent grid points to the significant midpoint.

VI CONCLUSION

This paper presents an outline of the main parts of a more extensive ongoing investigation into Composite Sampling. Attention was given to two main issues, i.e., to the criteria for local grid densification in Progressive Sampling, and to the rules for Selective Sampling of the distinct and anomalous features in terrain relief.

From the experimental tests applied to selected ideal geometric primitives and their composite as the input, some additional rules for SS and CS have been extracted. Further tests are ongoing with real terrain relief as the input.

The rule base for Selective and thus for Composite Sampling is expected to be further extended and thus upgraded with the aim of optimizing the overall procedure.

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