
FRACTALCOMS

***Exploring the limits of Fractal Electrodynamics
for the future telecommunication technologies
IST-2001-33055***



2nd Workshop UPC-CIMNE

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Abstract:

Summary of the workshop held at UPC on 19-7-2002 in order to discuss with CIMNE the task to do in the second semester of the project.

Keyword list: Triangles, meshing, IFS, fractals

RELATED WP AND TASKS (FROM THE PROJECT DESCRIPTION)

WP3: Software simulation tool

Task 3.1: Advanced meshing of fractal structures

- b) Advanced adaptive meshing facilities will be developed for fractal domains (CIMNE). In a first phase, conventional meshing algorithms will be adapted to the requirements of the present project. In a second phase, the production of fractal meshes for the discretization of fractal domains will be evaluated and, if possible, the corresponding algorithms will be developed and coded.

1 OBJECTIVES

- Discuss if a universal tool for meshing any pre-fractal defined by an IFS will be developed by CIMNE or, on the contrary, CIMNE will create many meshing utilities for different IFS geometries.
- Establish the mesh definition output for the new code to be developed in GiD.

2 SUMMARY

- a) It is agreed that CIMNE will develop a universal tool for meshing any pre-fractal defined by an IFS.

In the first place only the simplest case will be considered: Pre-fractal curves with no intersections, no common nodes and no bifurcations.

- b) The meshing algorithm is discussed:
 - The *initiator* will be defined by a curve of straight segments, consisting on a list of 3D points.
 - The *generator* can be 1D (e.g. the Koch curve) or 2D (e.g. the Sierpinski fractal). In the first place only the 1-D case will be considered. The *generator* will be also defined by a curve of straight segments, consisting on a list of 3D points. This curve will be obtained as the 1st iteration of the IFS with the simplest initiator (usually a straight segment).
 - The IFS iterations will be obtained by applying the generator to itself (at a given iteration, each segment of the structure is replaced by the whole structure of the previous iteration).
 - The final pre-fractal will be obtained by substituting all the segments of the structure by the initiator.
 - The pre-fractal curve must be transformed into a strip.
 - The strip will be meshed with GiD. It is suggested that a structured mesh is used for all strip segments.
- c) UPC will send CIMNE printed information about pre-fractals and IFS, containing the definition of the *initiator* and the *generator*.

- d) UPC will send CIMNE an algorithm to convert a pre-fractal curve into a strip, including the more complicated cases with intersections and bifurcations.
- e) It is agreed that developing a mesh numbering scheme that produces a linear system with recursive block structure is of less importance than having a general tool to mesh pre-fractal strips generated by a IFS.
- f) It is agreed that the mesh output format will be the following:

```

MESH      dimension = 3 ElemType Triangle Nnode = 3
Coordinates
1          0          -0.25          0
2      0.095859      -0.230892          0
3          0      -0.230892      -0.095859
4      -0.095859      -0.230892          0
5          0      -0.230892      0.095859
6      -0.126545      -0.201497      0.076715
7      -0.076715      -0.201497      -0.126545
8          0.076715      -0.201497      0.126545
9          0.126545      -0.201497      -0.076715
10         0          -0.176677      -0.176876
11        0.176876      -0.176677          0
12         0          -0.176677      0.176876
13       -0.176876      -0.176677          0
14       -0.154281      -0.144486      -0.133497
15          0.133497      -0.144486      -0.154281
16          0.154281      -0.144486      0.133497
17       -0.133497      -0.144486      0.154281
18       -0.080074      -0.135125      -0.194497
19          0.080074      -0.135125      0.194497
20       -0.194497      -0.135125      0.080074
21          0.194497      -0.135125      -0.080074
22          0.231059      -0.095455          0
23          0          -0.095455      -0.231059
24          0          -0.095455      0.231059
25       -0.231059      -0.095455          0
26          0.08573      -0.09122      -0.216401
27          -0.08573      -0.09122      0.216401
28       -0.216401      -0.09122      -0.08573
29          0.216401      -0.09122      0.08573
30          0.156961      -0.07881      0.177911
31       -0.177911      -0.07881      0.156961
32          0.177911      -0.07881      -0.156961
33       -0.156961      -0.07881      -0.177911
34          0.083256      -0.045887      0.23122
35          -0.23122      -0.045887      0.083256
36       -0.083256      -0.045887      -0.23122
37          0.23122      -0.045887      -0.083256
38          0          0          0.25
39          0.25          0          0
40          -0.25          0          0
41          0          0          -0.25
42          0.162604      0.001914      -0.189885
43       -0.189885      0.001914      -0.162604
44       -0.162604      0.001914      0.189885
45          0.189885      0.001914      0.162604
46          0.231231      0.050902      -0.080256
47       -0.231231      0.050902      0.080256
48          0.080256      0.050902      0.231231
49       -0.080256      0.050902      -0.231231
50          0.178394      0.083085      -0.154183
51       -0.178394      0.083085      0.154183
52          0.154183      0.083085      0.178394
53       -0.154183      0.083085      -0.178394
54          0.215324      0.093601      0.085874
55          0.085874      0.093601      -0.215324
56       -0.085874      0.093601      0.215324
57       -0.215324      0.093601      -0.085874
58          0          0.095854      -0.230894
59          0          0.095854      0.230894
60          0.230894      0.095854          0
61       -0.230894      0.095854          0

```

62	0.076682	0.138361	0.193587
63	-0.076682	0.138361	-0.193587
64	0.193587	0.138361	-0.076682
65	-0.193587	0.138361	0.076682
66	0.134006	0.146634	-0.151792
67	0.151792	0.146634	0.134006
68	-0.134006	0.146634	0.151792
69	-0.151792	0.146634	-0.134006
70	-0.176683	0.176871	0
71	0	0.176871	0.176683
72	0	0.176871	-0.176683
73	0.176683	0.176871	0
74	0.074304	0.203052	0.125495
75	-0.125495	0.203052	0.074304
76	0.125495	0.203052	-0.074304
77	-0.074304	0.203052	-0.125495
78	-0.095461	0.231057	0
79	0.095461	0.231057	0
80	0	0.231057	0.095461
81	0	0.231057	-0.095461
82	0	0.25	0

end coordinates

Elements

1	22	39	37
2	37	39	46
3	22	37	21
4	21	37	32
5	22	21	11
6	11	21	9
7	9	21	15
8	11	9	2
9	2	9	3
10	15	21	32
11	15	32	26
12	26	32	42
13	15	26	10
14	42	37	46
15	26	42	41
16	9	15	10
17	46	39	60
18	46	60	64
19	64	60	73
20	64	73	76
21	76	73	79
22	76	79	81
23	64	76	66
24	46	64	50
25	66	76	72
26	64	66	50
27	50	66	55
28	55	66	72
29	50	55	42
30	42	55	41
31	50	42	46
32	37	42	32
33	79	82	81
34	41	23	26
35	72	58	55
36	10	3	9
37	81	72	76
38	23	10	26
39	1	2	3
40	58	41	55
41	23	41	36
42	36	41	49
43	23	36	18
44	18	36	33
45	23	18	10
46	10	18	7
47	7	18	14
48	10	7	3
49	3	7	4
50	14	18	33
51	14	33	28
52	28	33	43
53	14	28	13

54	43	36	49
55	28	43	40
56	7	14	13
57	49	41	58
58	49	58	63
59	63	58	72
60	63	72	77
61	77	72	81
62	77	81	78
63	63	77	69
64	49	63	53
65	69	77	70
66	63	69	53
67	53	69	57
68	57	69	70
69	53	57	43
70	43	57	40
71	53	43	49
72	36	43	33
73	81	82	78
74	40	25	28
75	70	61	57
76	13	4	7
77	78	70	77
78	25	13	28
79	1	3	4
80	61	40	57
81	25	40	35
82	35	40	47
83	25	35	20
84	20	35	31
85	25	20	13
86	13	20	6
87	6	20	17
88	13	6	4
89	4	6	5
90	17	20	31
91	17	31	27
92	27	31	44
93	17	27	12
94	44	35	47
95	27	44	38
96	6	17	12
97	47	40	61
98	47	61	65
99	65	61	70
100	65	70	75
101	75	70	78
102	75	78	80
103	65	75	68
104	47	65	51
105	68	75	71
106	65	68	51
107	51	68	56
108	56	68	71
109	51	56	44
110	44	56	38
111	51	44	47
112	35	44	31
113	78	82	80
114	38	24	27
115	71	59	56
116	12	5	6
117	80	71	75
118	24	12	27
119	1	4	5
120	59	38	56
121	24	38	34
122	34	38	48
123	24	34	19
124	19	34	30
125	24	19	12
126	12	19	8
127	8	19	16
128	12	8	5
129	5	8	2
130	16	19	30

```

131      16      30      29
132      29      30      45
133      16      29      11
134      45      34      48
135      29      45      39
136       8      16      11
137      48      38      59
138      48      59      62
139      62      59      71
140      62      71      74
141      74      71      80
142      74      80      79
143      62      74      67
144      48      62      52
145      67      74      73
146      62      67      52
147      52      67      54
148      54      67      73
149      52      54      45
150      45      54      39
151      52      45      48
152      34      45      30
153      80      82      79
154      39      22      29
155      73      60      54
156      11       2       8
157      79      73      74
158      22      11      29
159       1       5       2
160      60      39      54
end elements

```

3 CONCLUSIONS

At the T0+12 meeting, a general tool to mesh pre-fractal strips generated by a IFS will be available. Only the simplest cases will be considered first. The numbering scheme that produces block-recursive matrices will be considered later.

DISCLAIMER

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