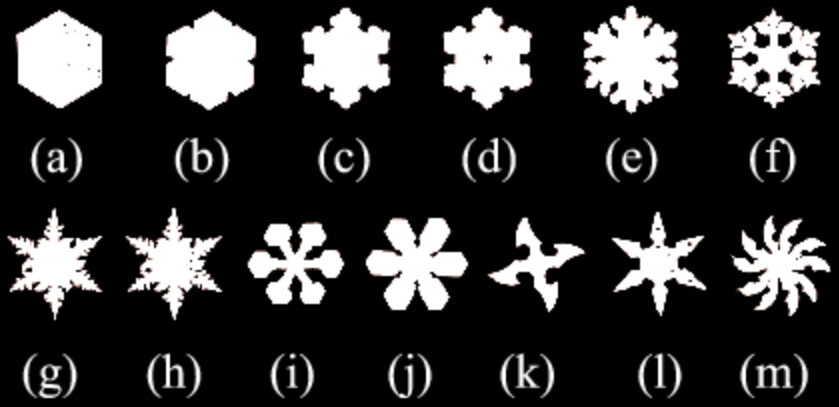
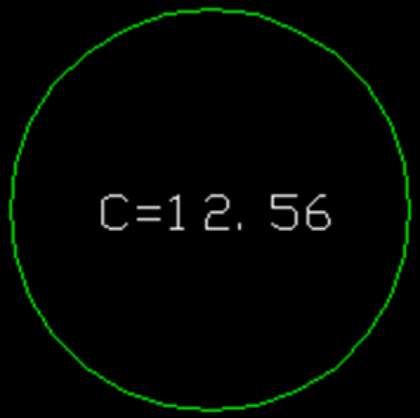
La Compacidad de las Formas

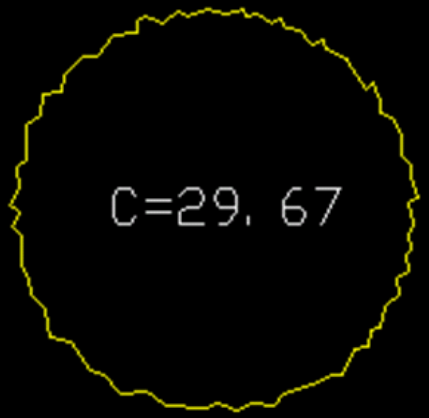
por Ernesto Bribiesca

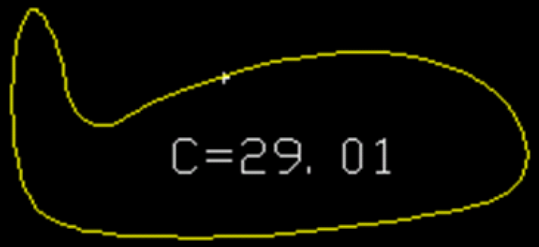


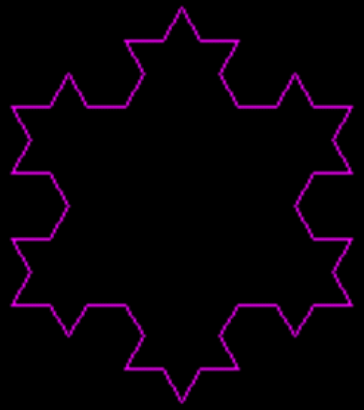
$C=P^2/A$

La Compacidad Clásica

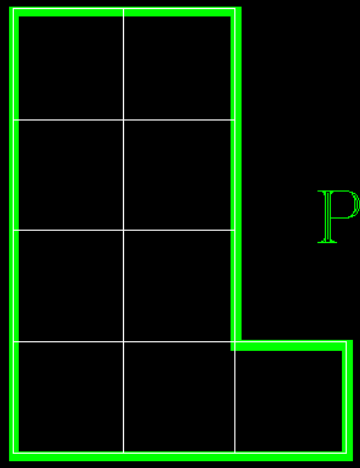




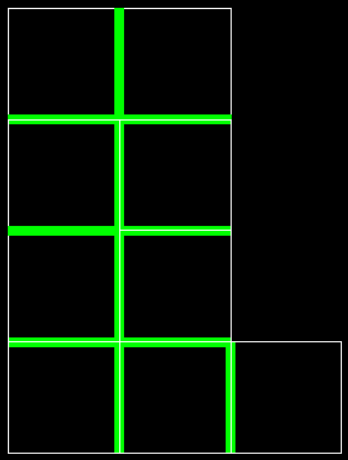




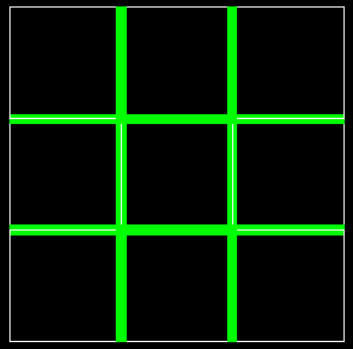
Perímetro de Contacto y Compacidad Discreta



$$P + 2P_c = 4n$$

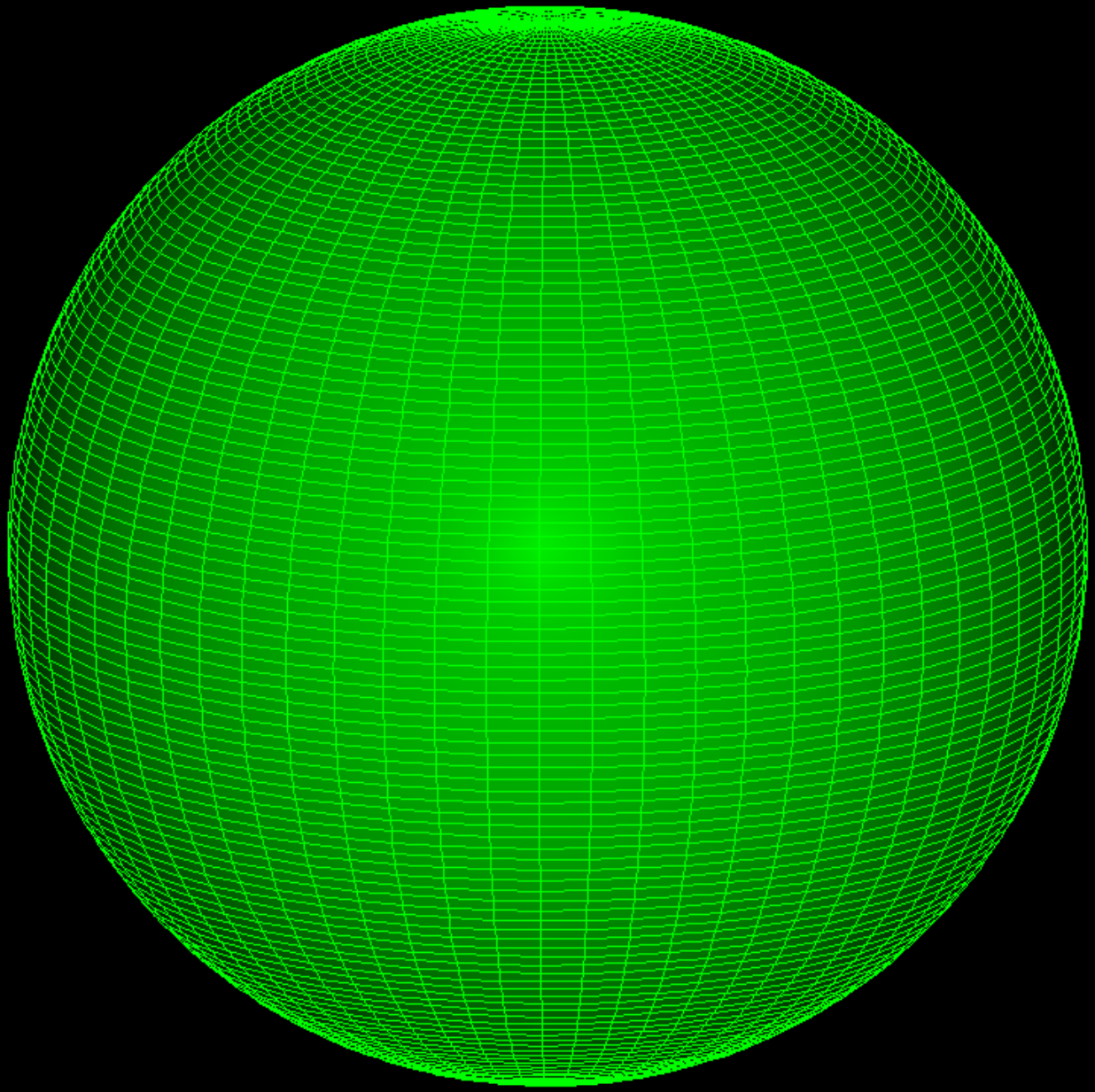


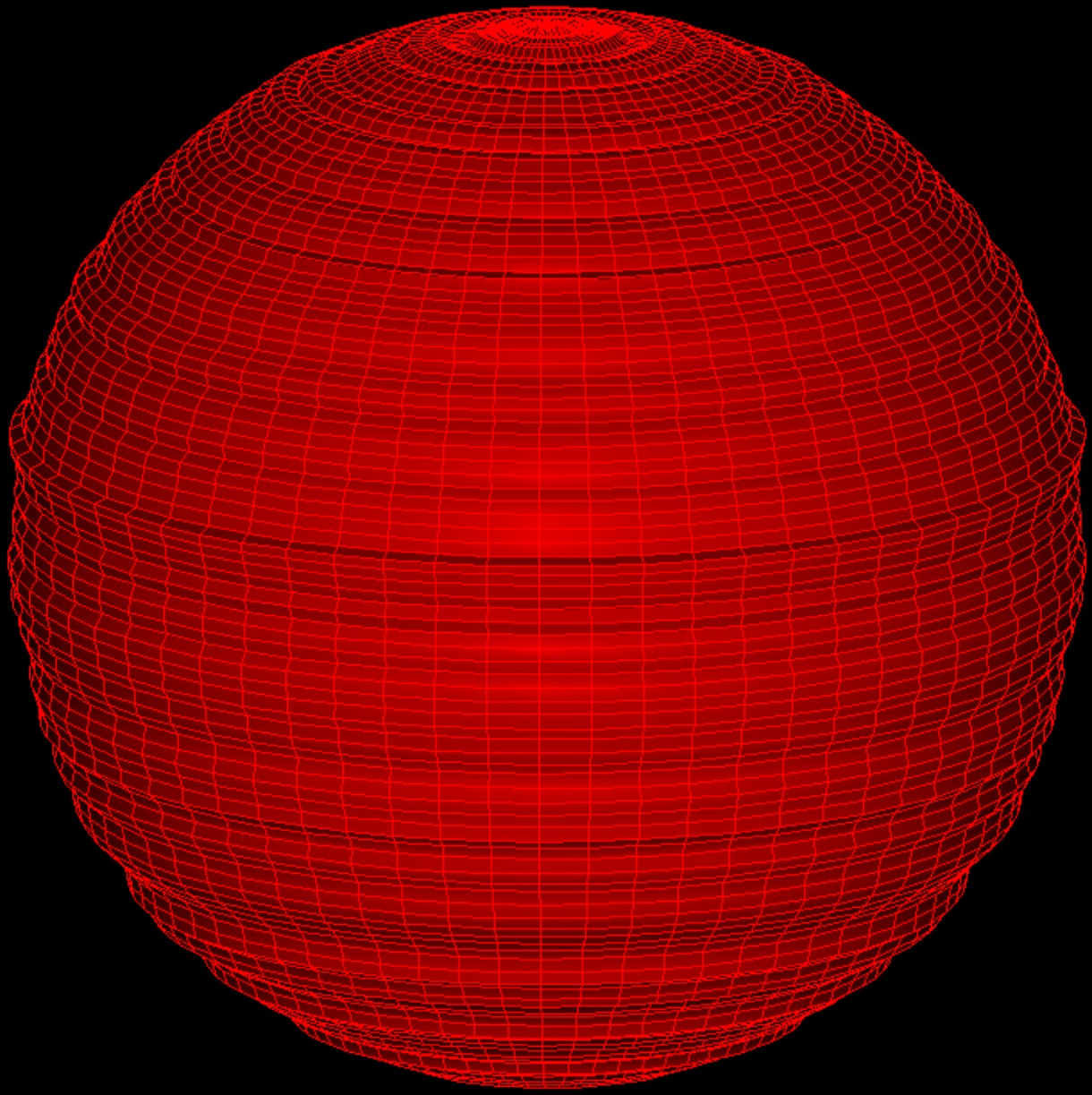
$$C_D = \frac{P_c}{P_{c\,max}}$$

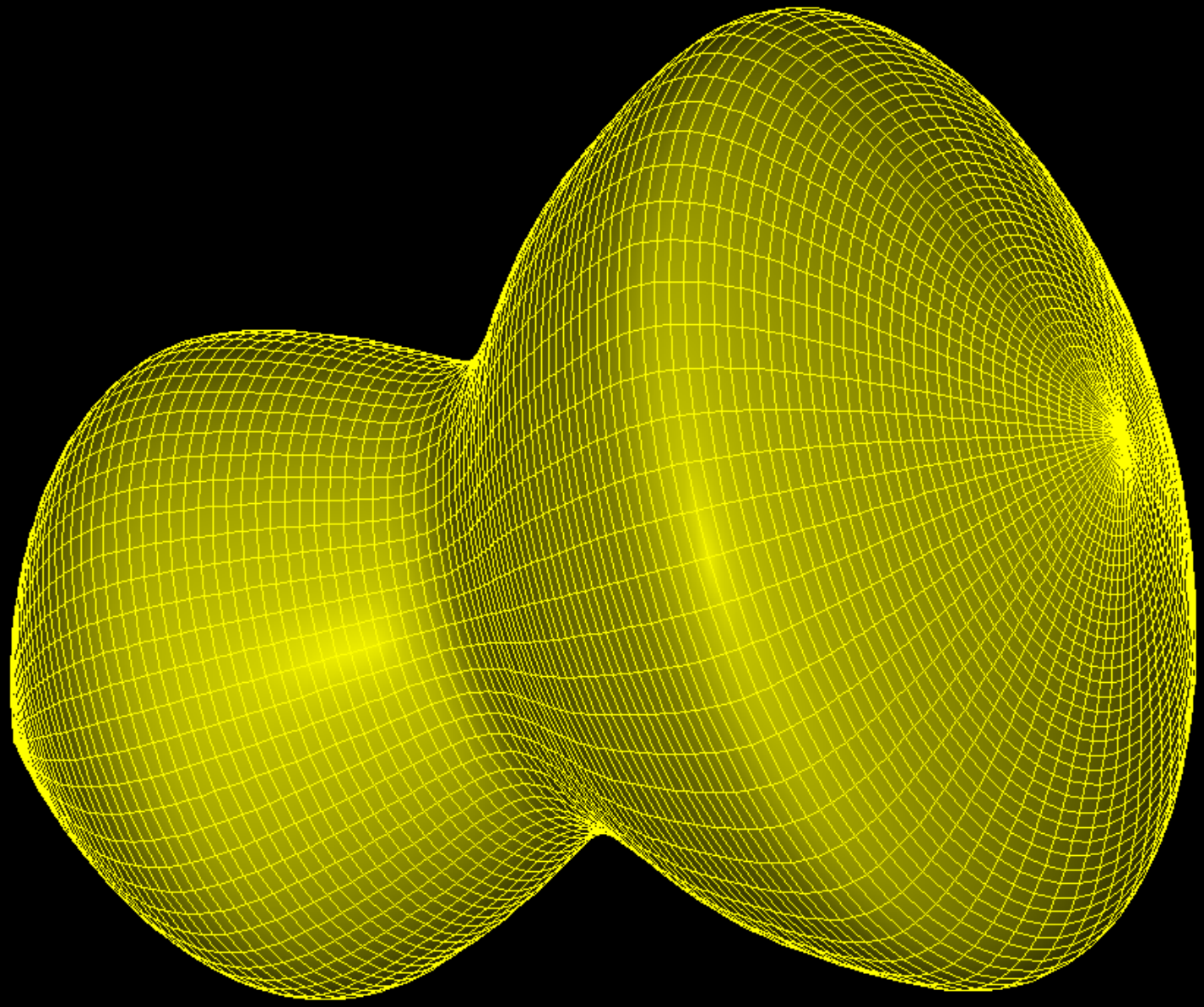


$$P_{c\,max} = \frac{4n - 4\sqrt{n}}{2}$$

$$P_{c\,max} = 2\left(n - \sqrt{n}\right)$$


C=113.0973

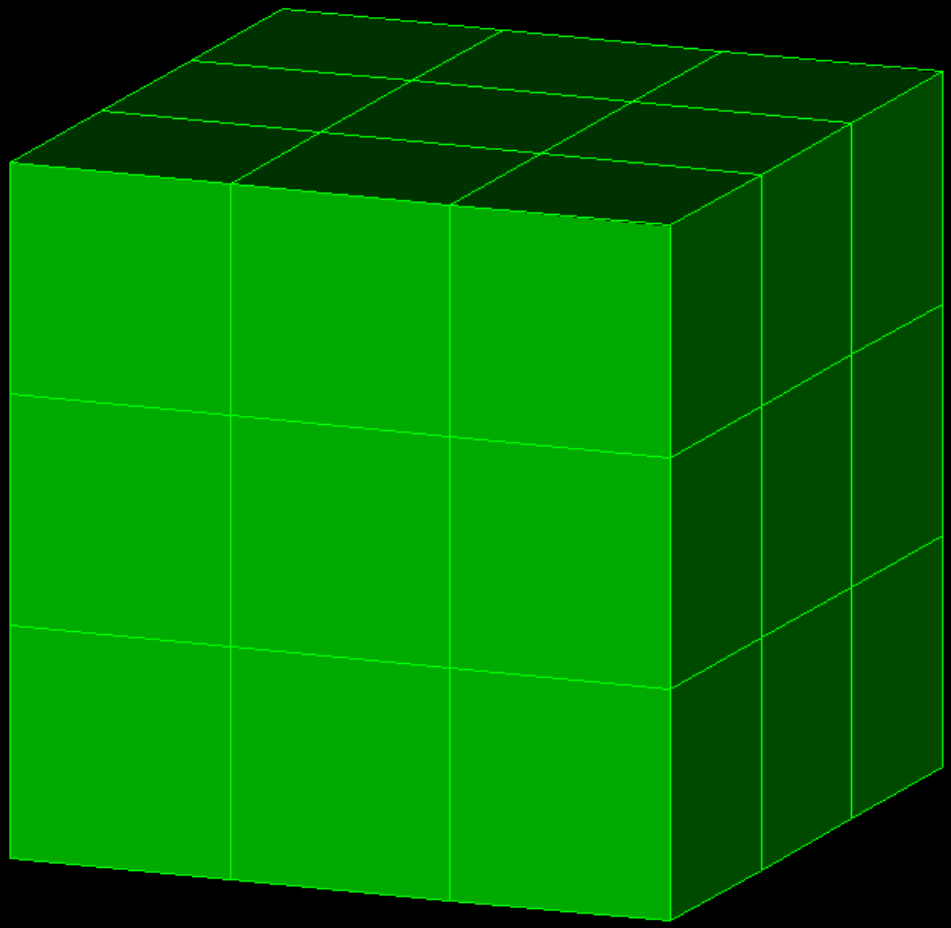

C=159.8176


C=123.4025

$$C_{\mathrm{d}} = \frac{n - P/4}{n - \sqrt{n}}.$$

$$C_{\mathrm{d}} = \frac{A_{\mathrm{c}}}{A_{\mathrm{c}_{\max}}}.$$

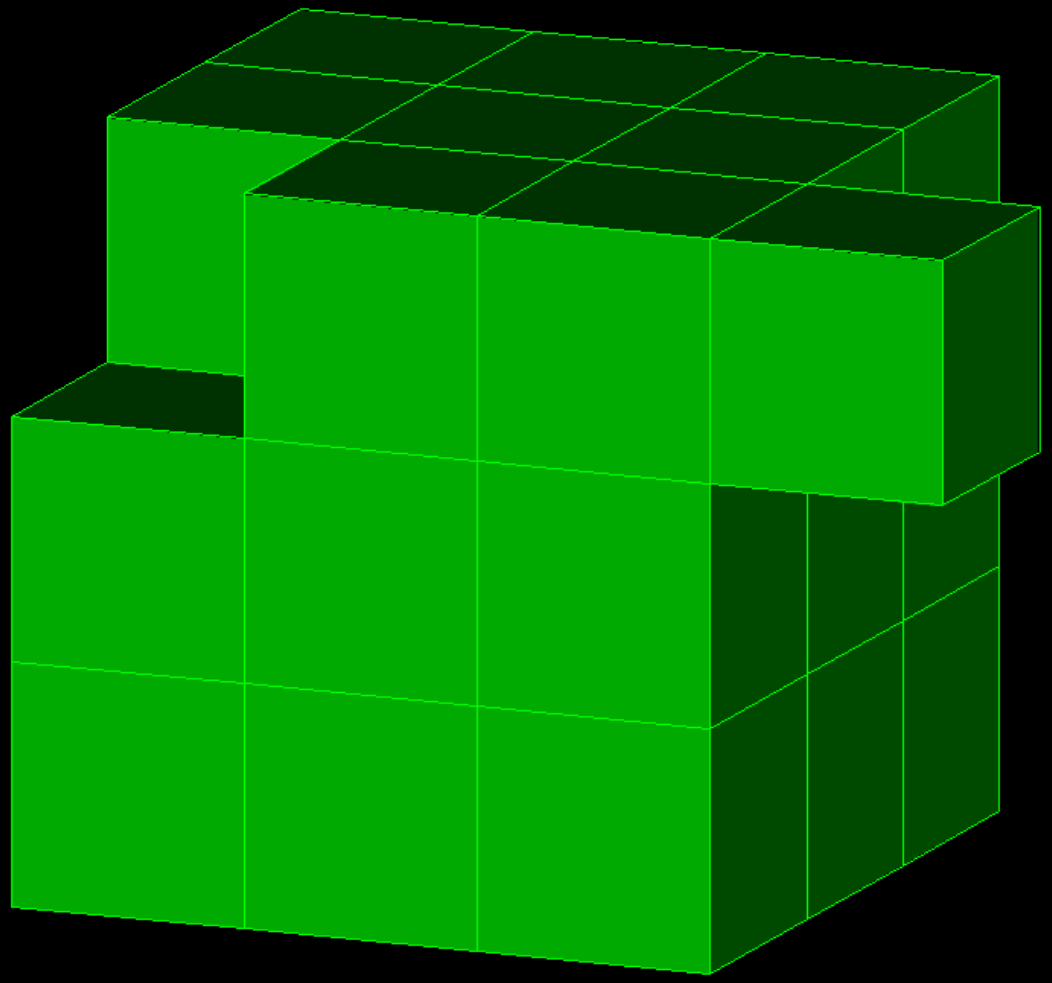
$$C_{\mathrm{d}} = \frac{n - A/6}{n - (\sqrt[3]{n})^2}.$$



(a) $n = 27$

$A_c = 54$

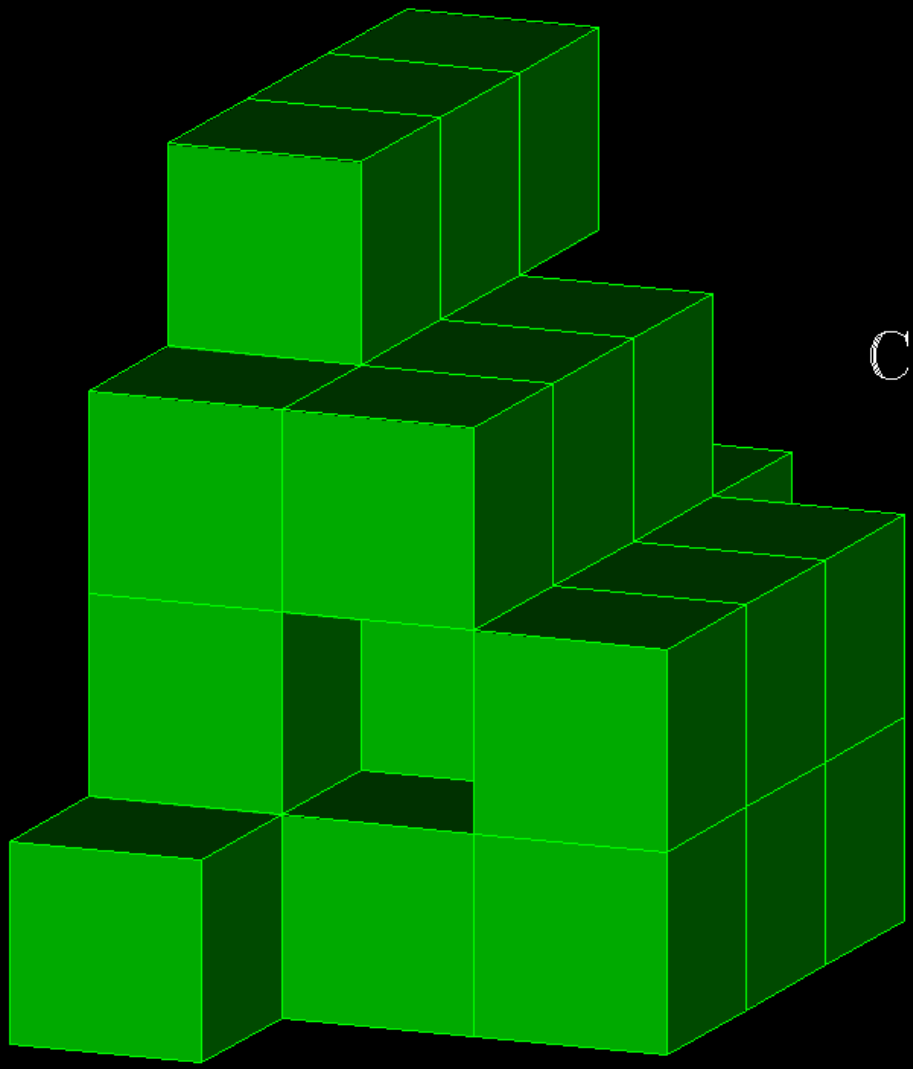
$C_d \equiv 1$



(b) n=27

$A_c = 52$

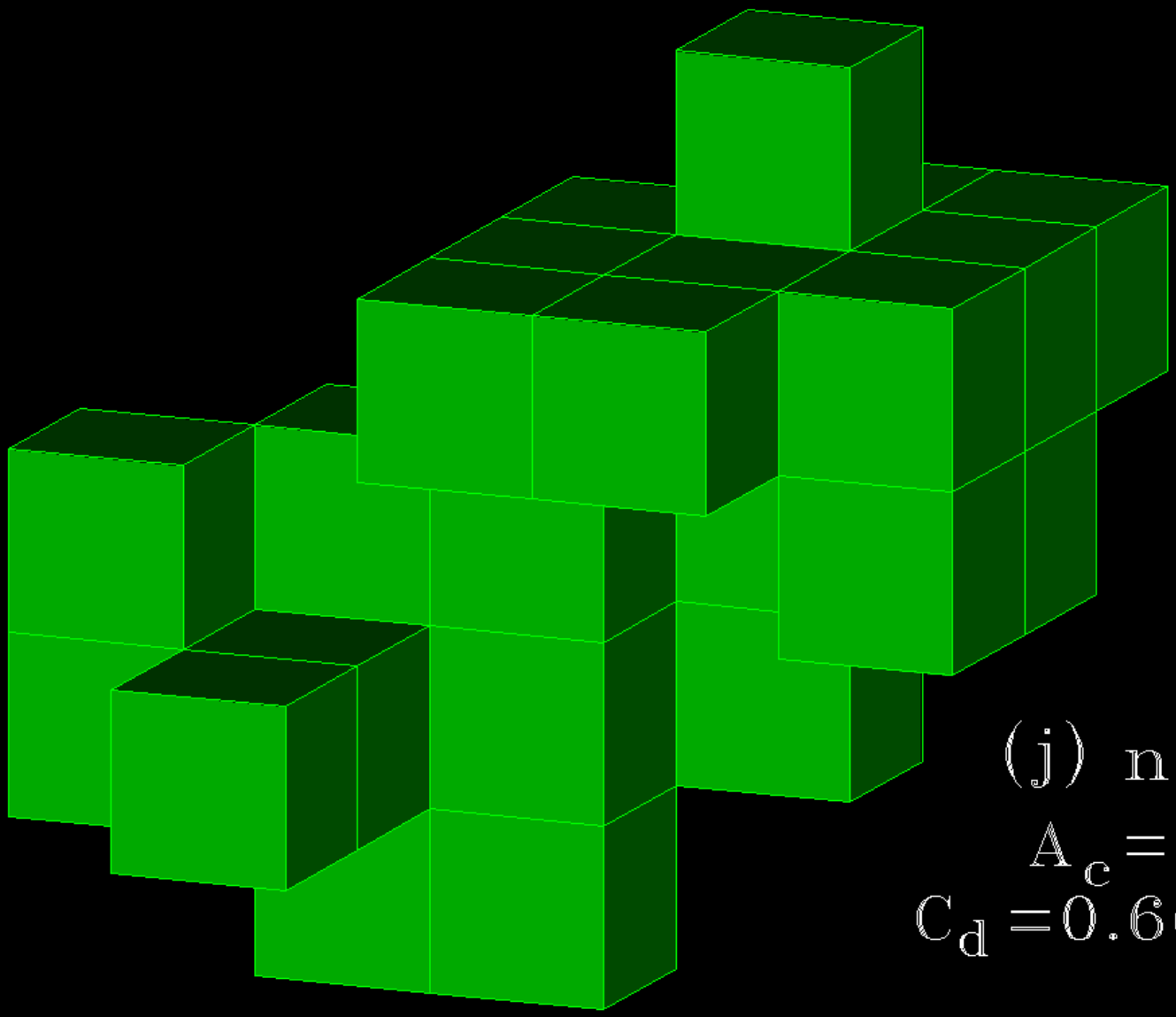
$C_d = 0.962962$



(f) n=27

A_c=44

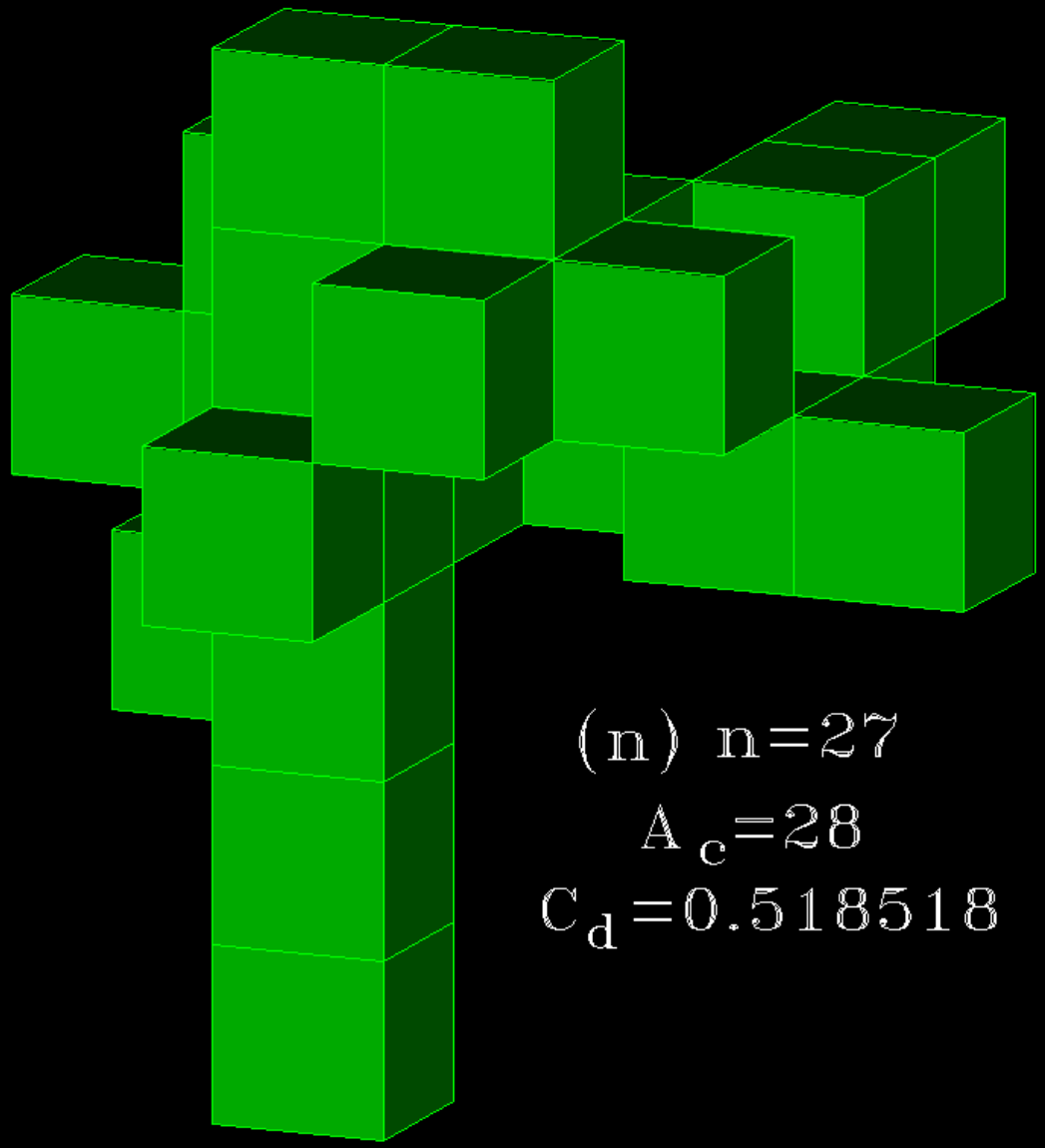
C_d=0.814814



(j) n=27

$A_c = 36$

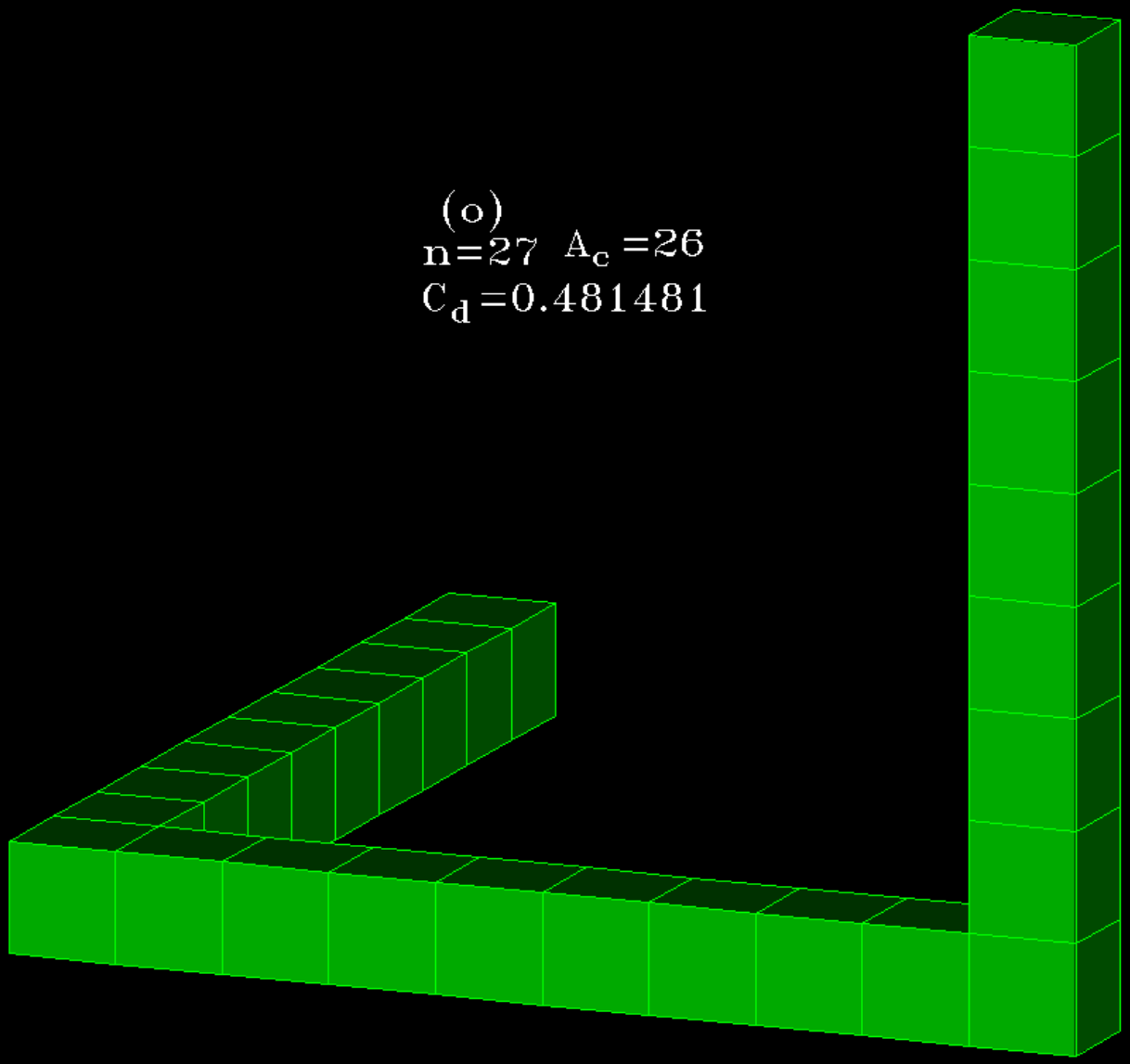
$C_d = 0.666666$

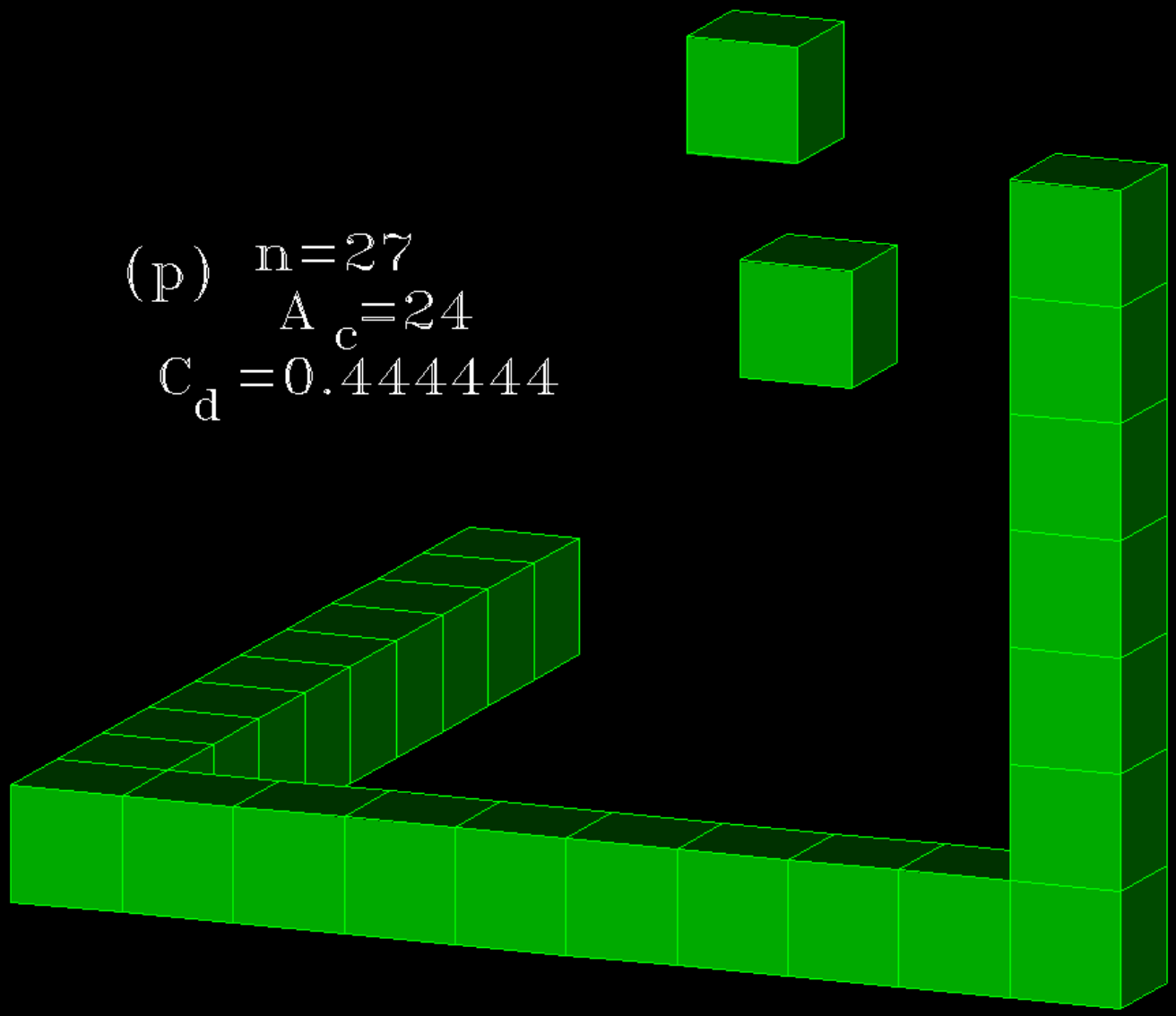


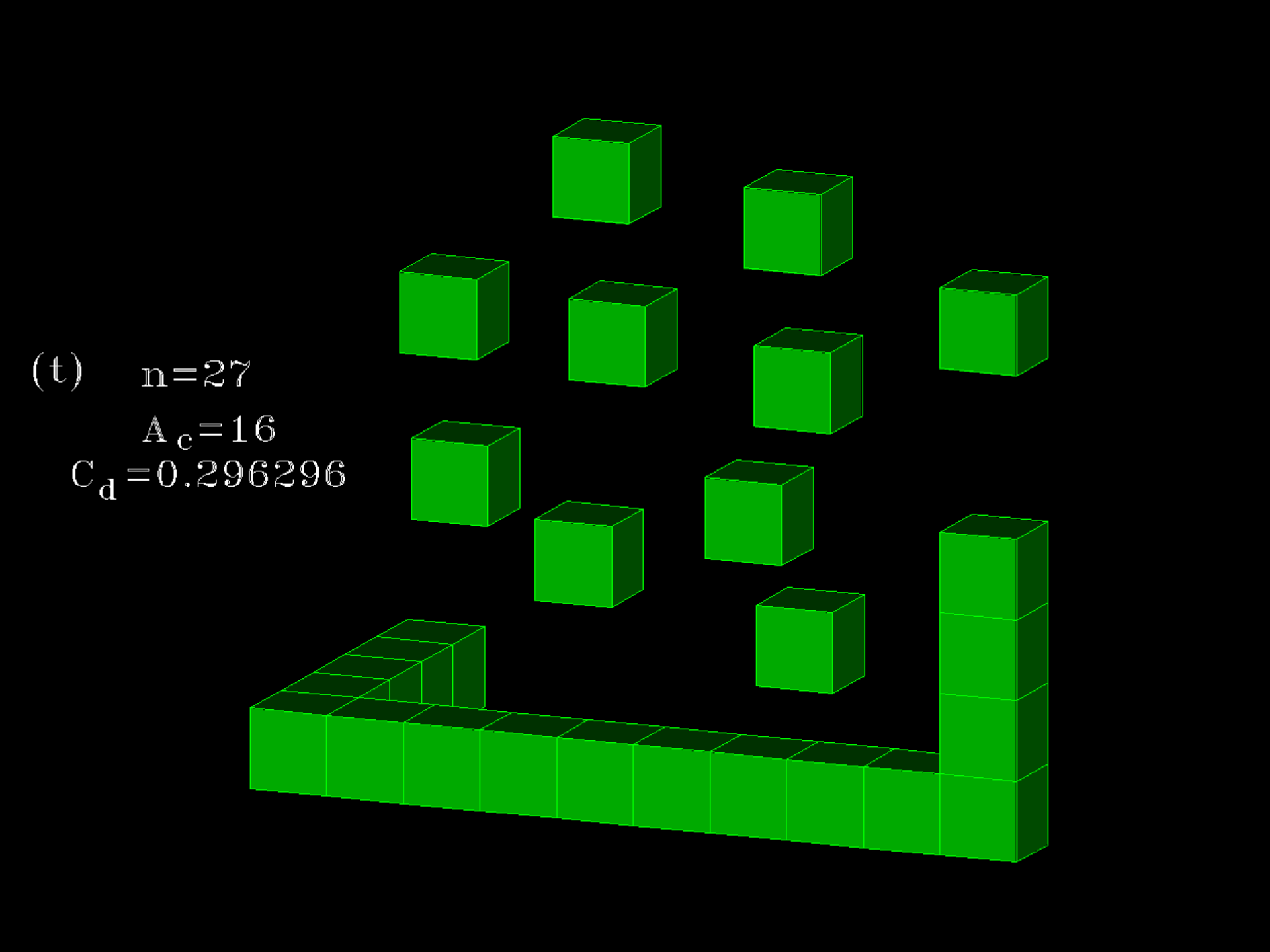
(n) n=27

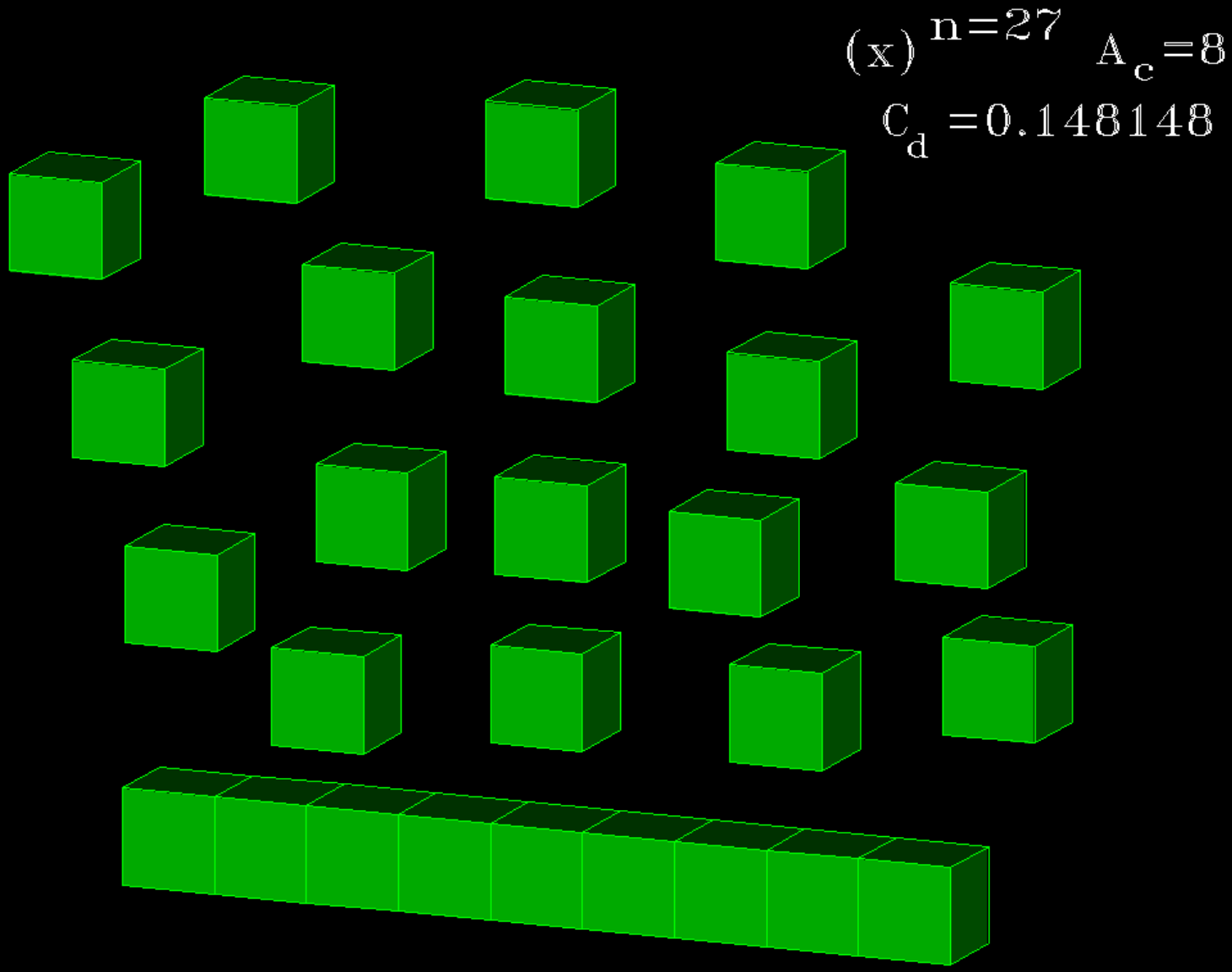
A_c=28

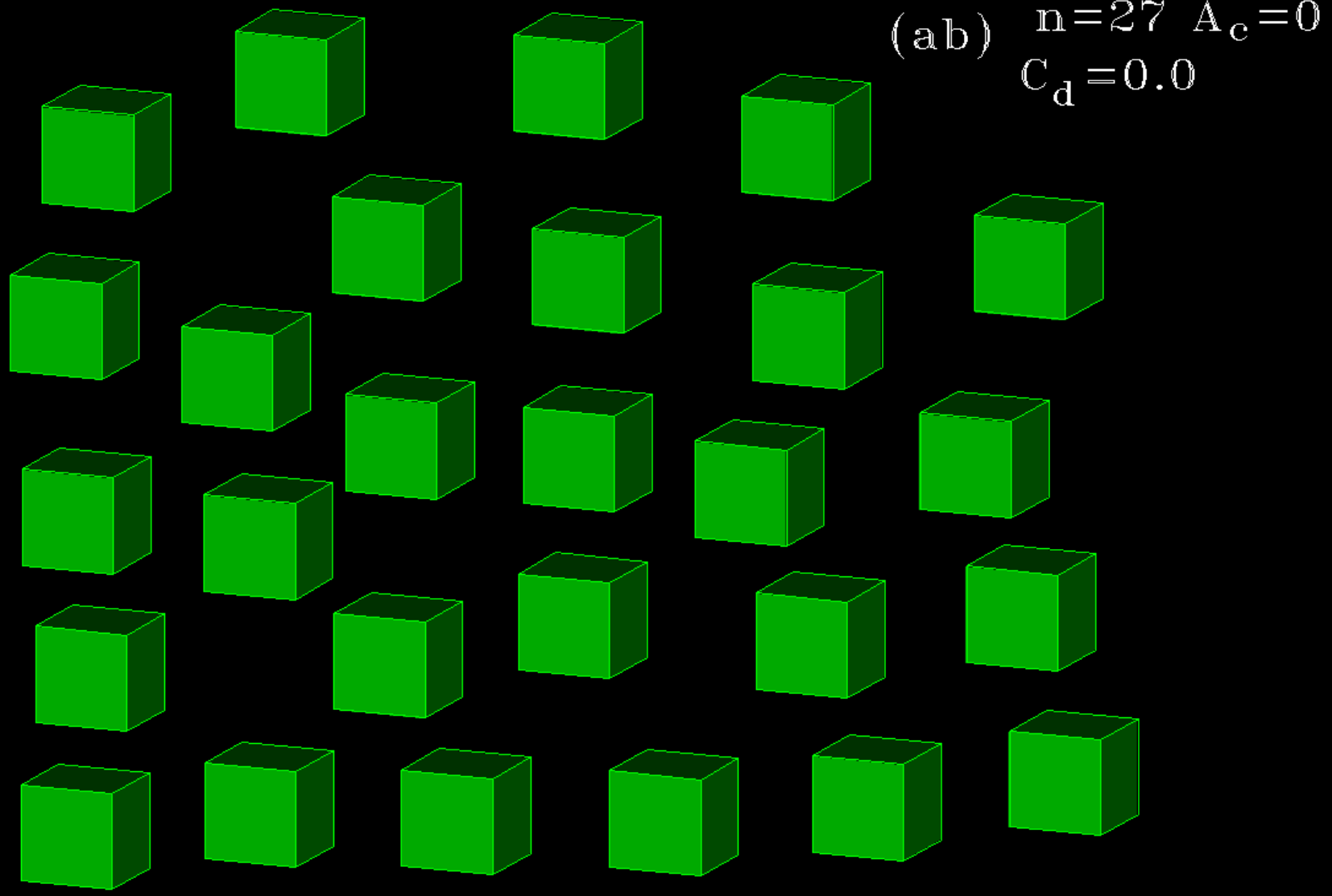
C_d=0.518518

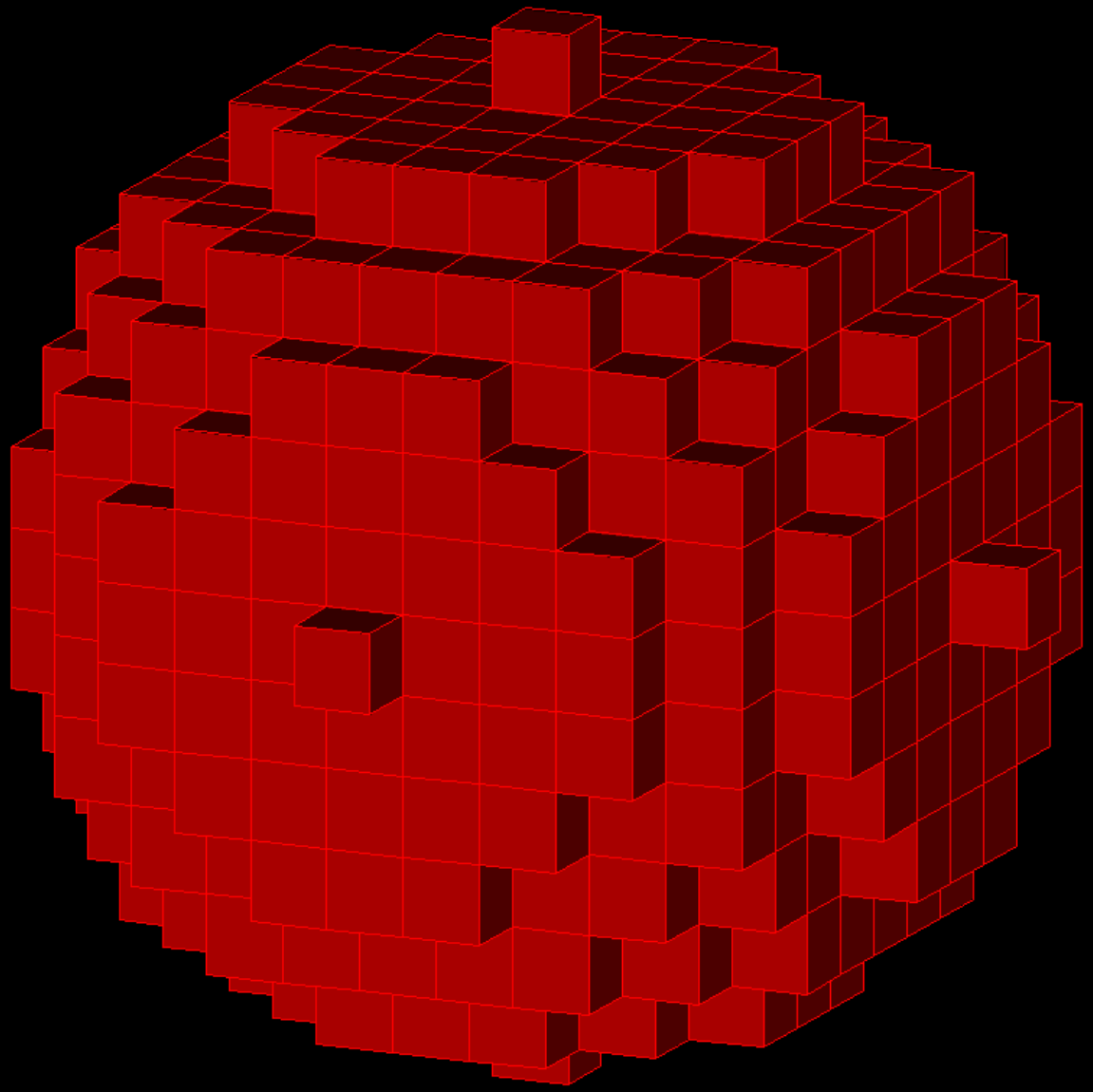

(o)
n=27 A_c=26
C_d=0.481481


(p) n=27
A c=24
C d =0.444444


(t)
n=27
A c=16
C d=0.296296


(x) n=27 A_c=8
C_d =0.148148


(ab) n=27 A_c=0
C_d=0.0

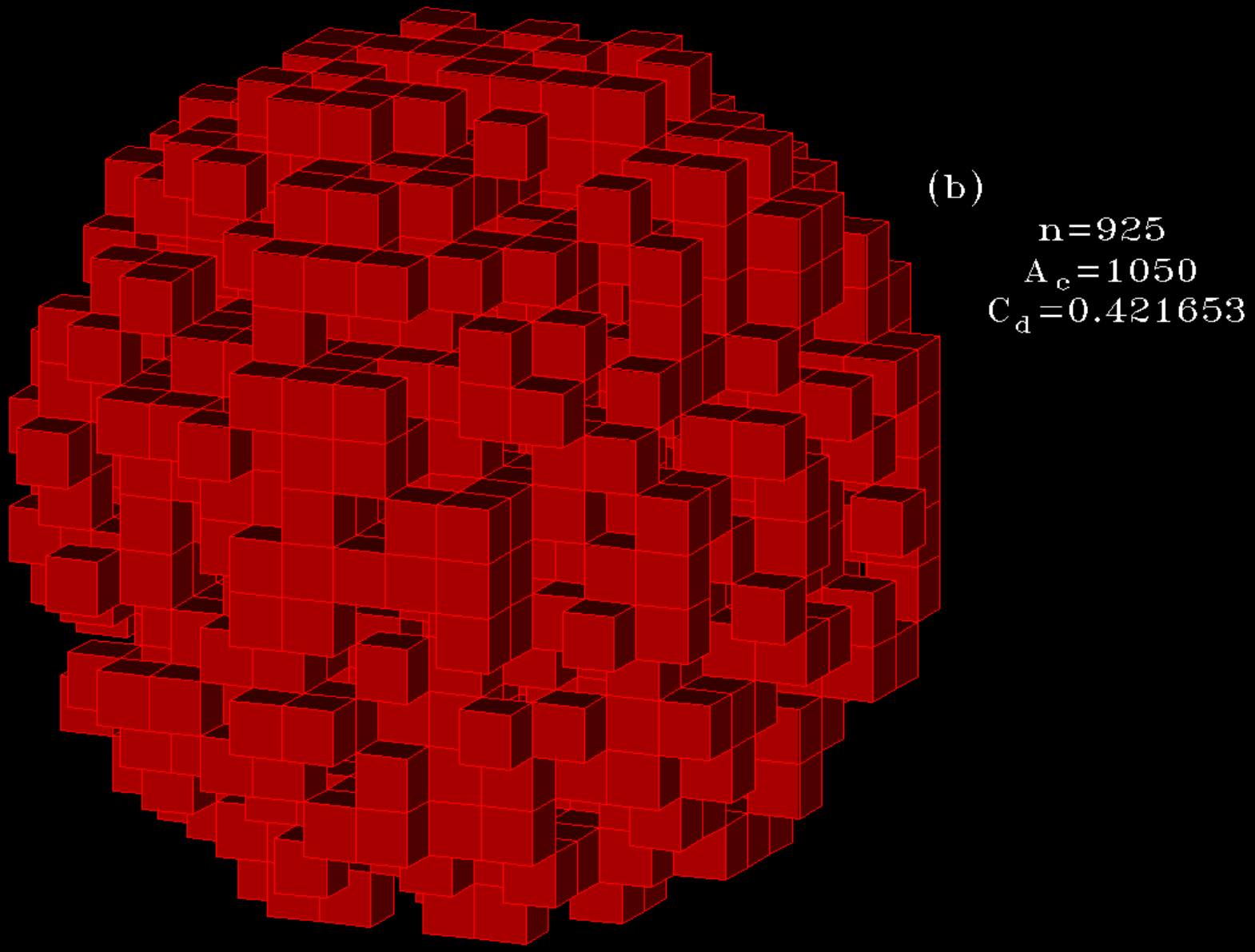


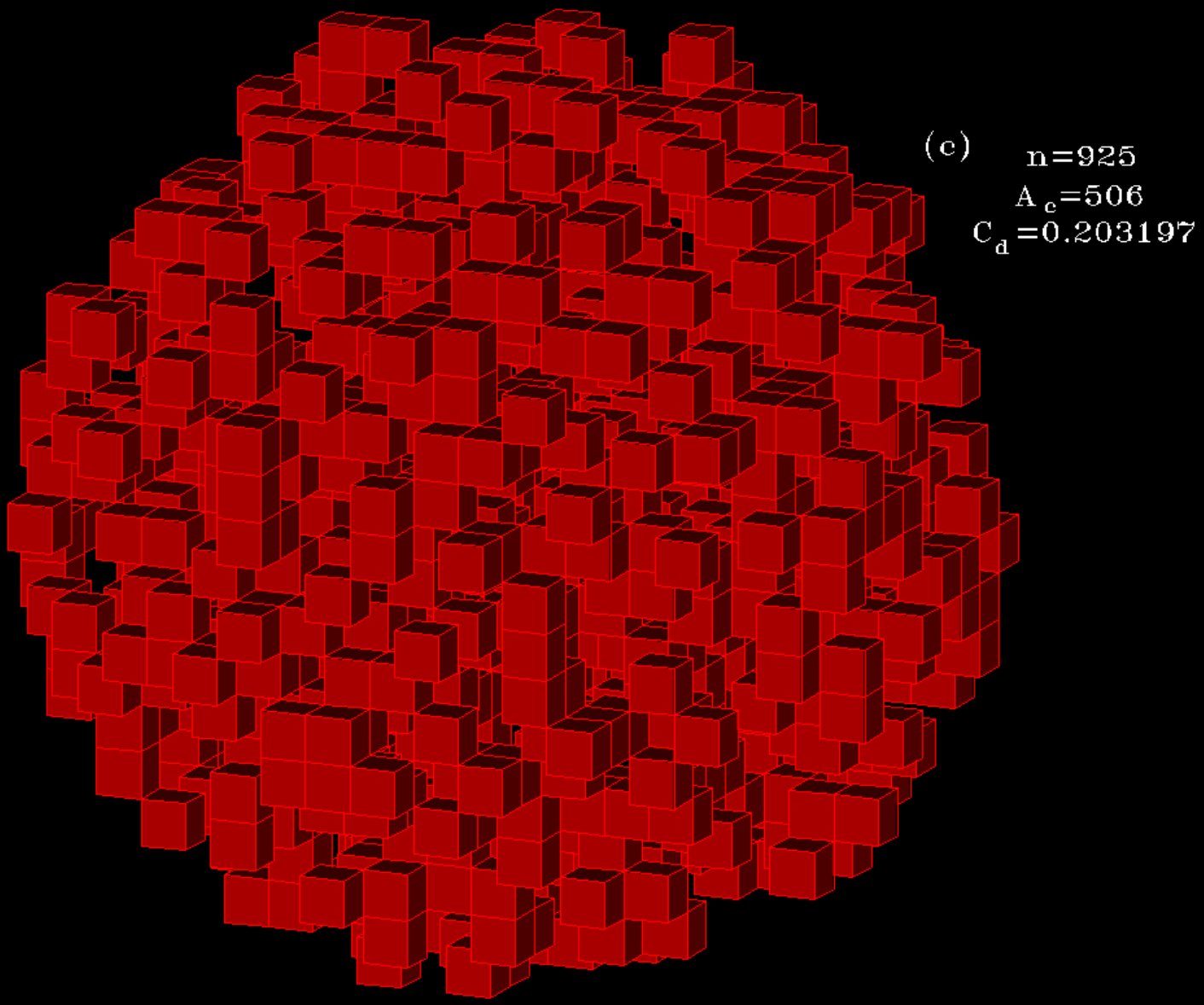
(a)

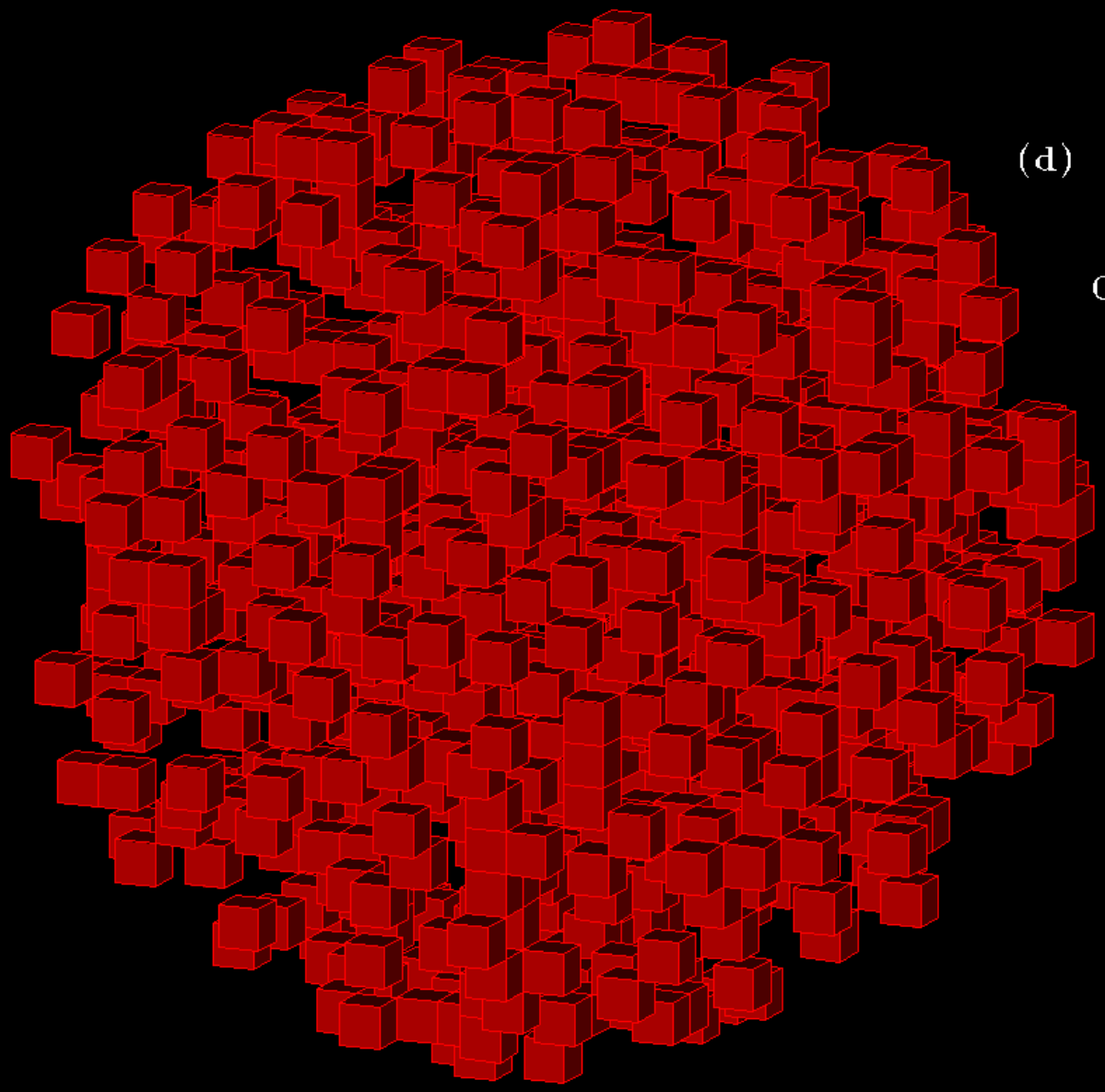
n=925

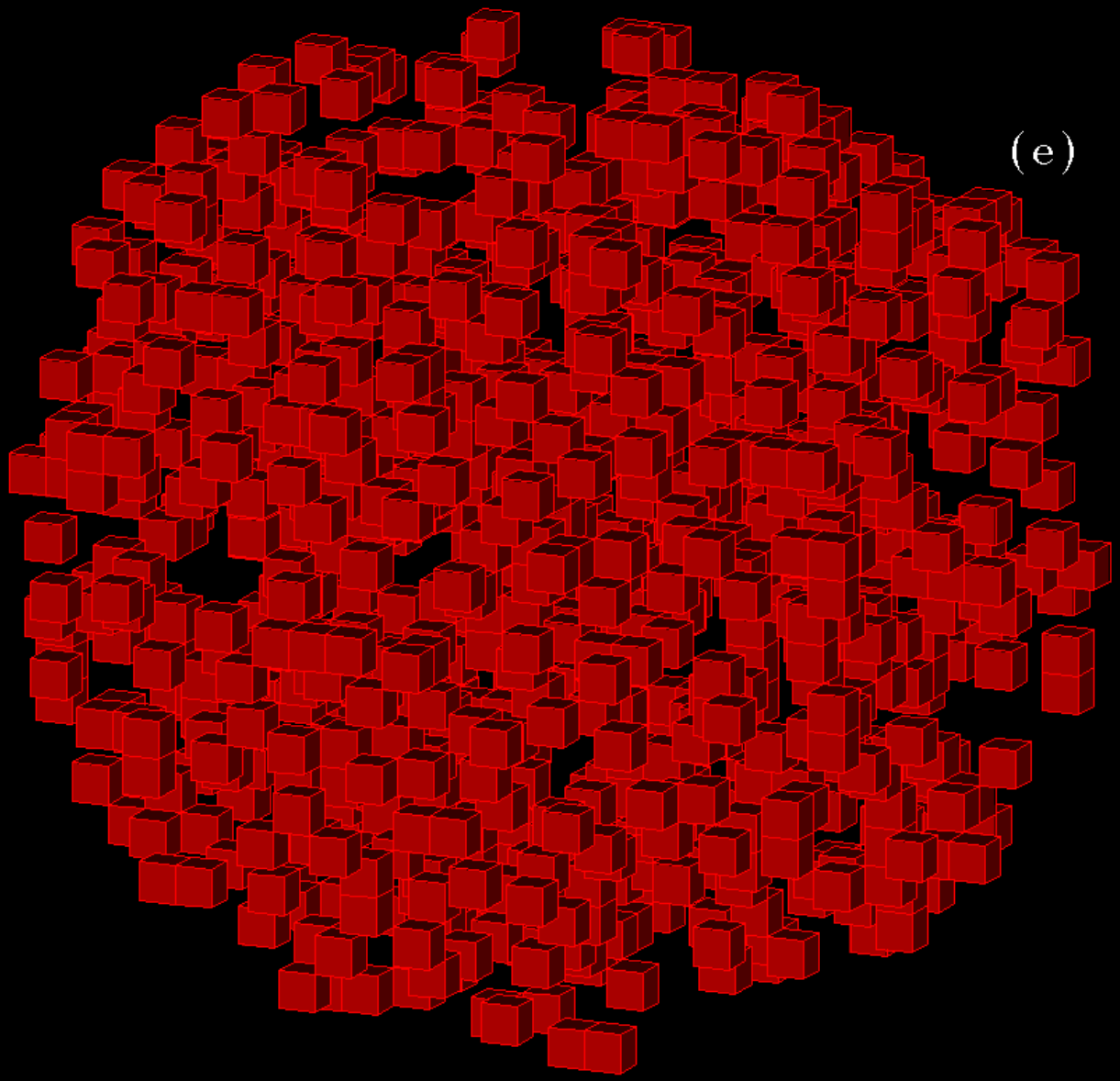
A_c =2436

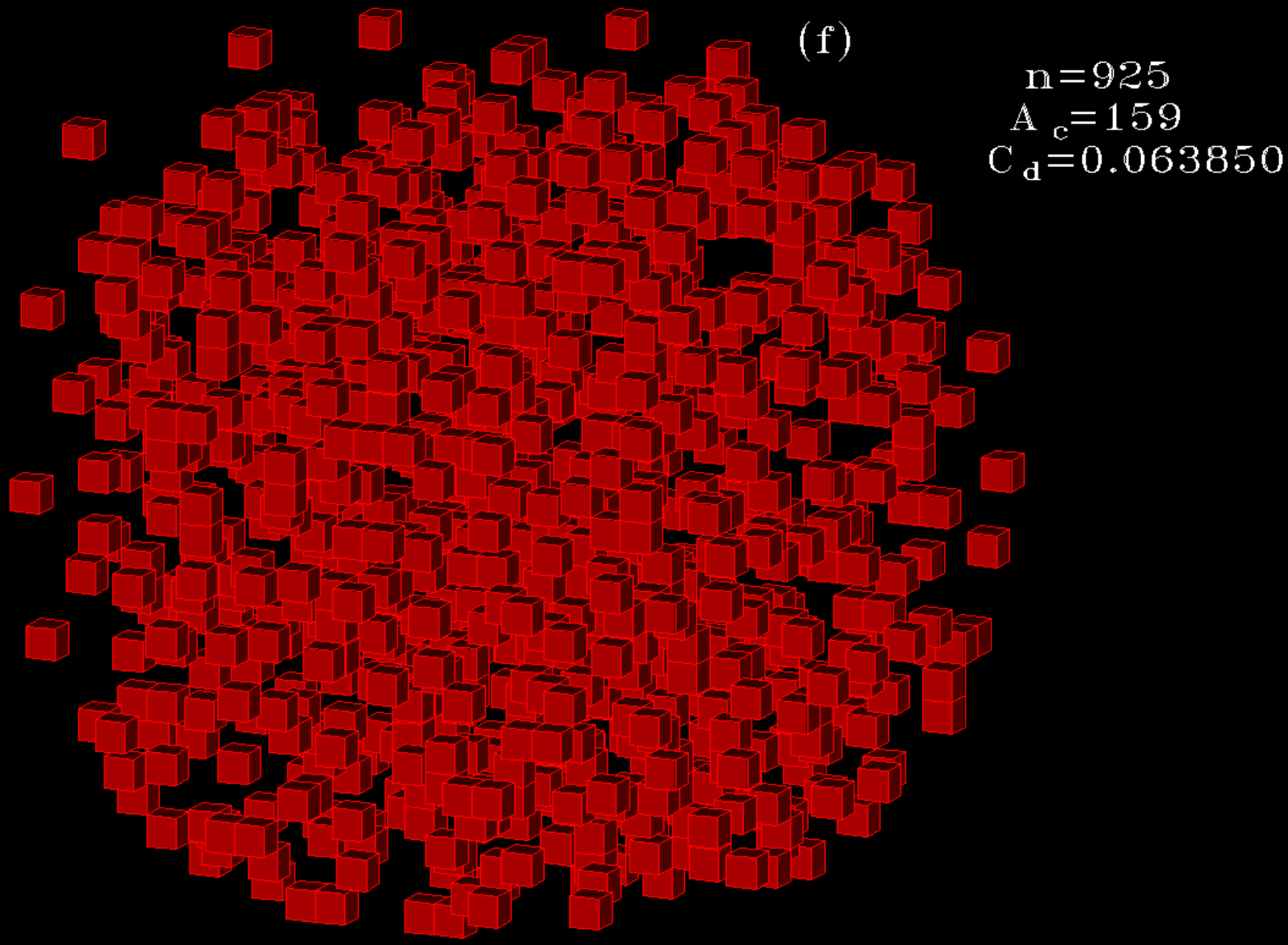
C_d =0.978237

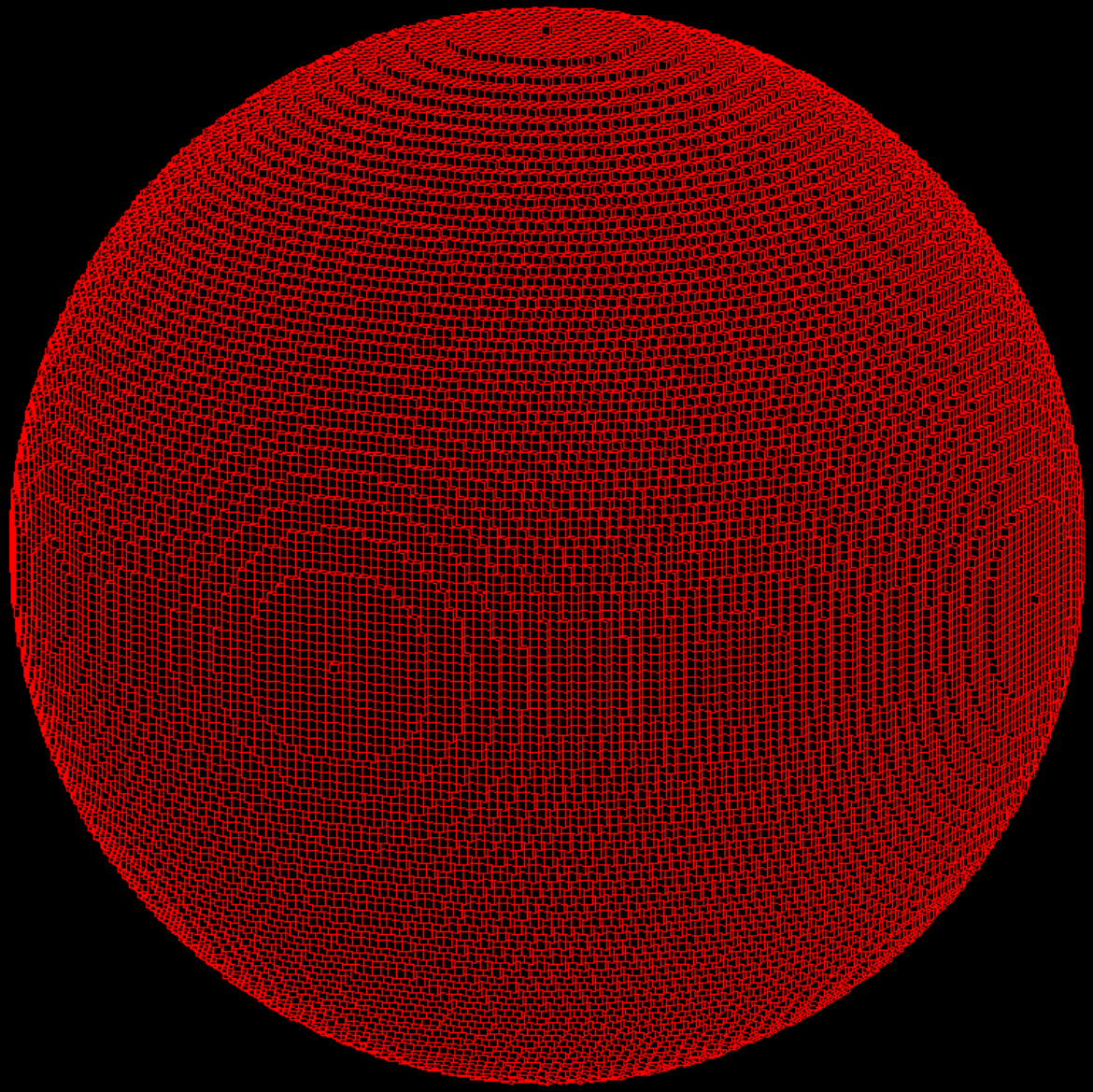

(b)
n=925
A c =1050
C d =0.421653


(c)
n=925
A c=506
C d=0.203197


(d)
n=925
A c =283
C d =0.113645


(e)
n=925
A_c=205
C_d=0.082322

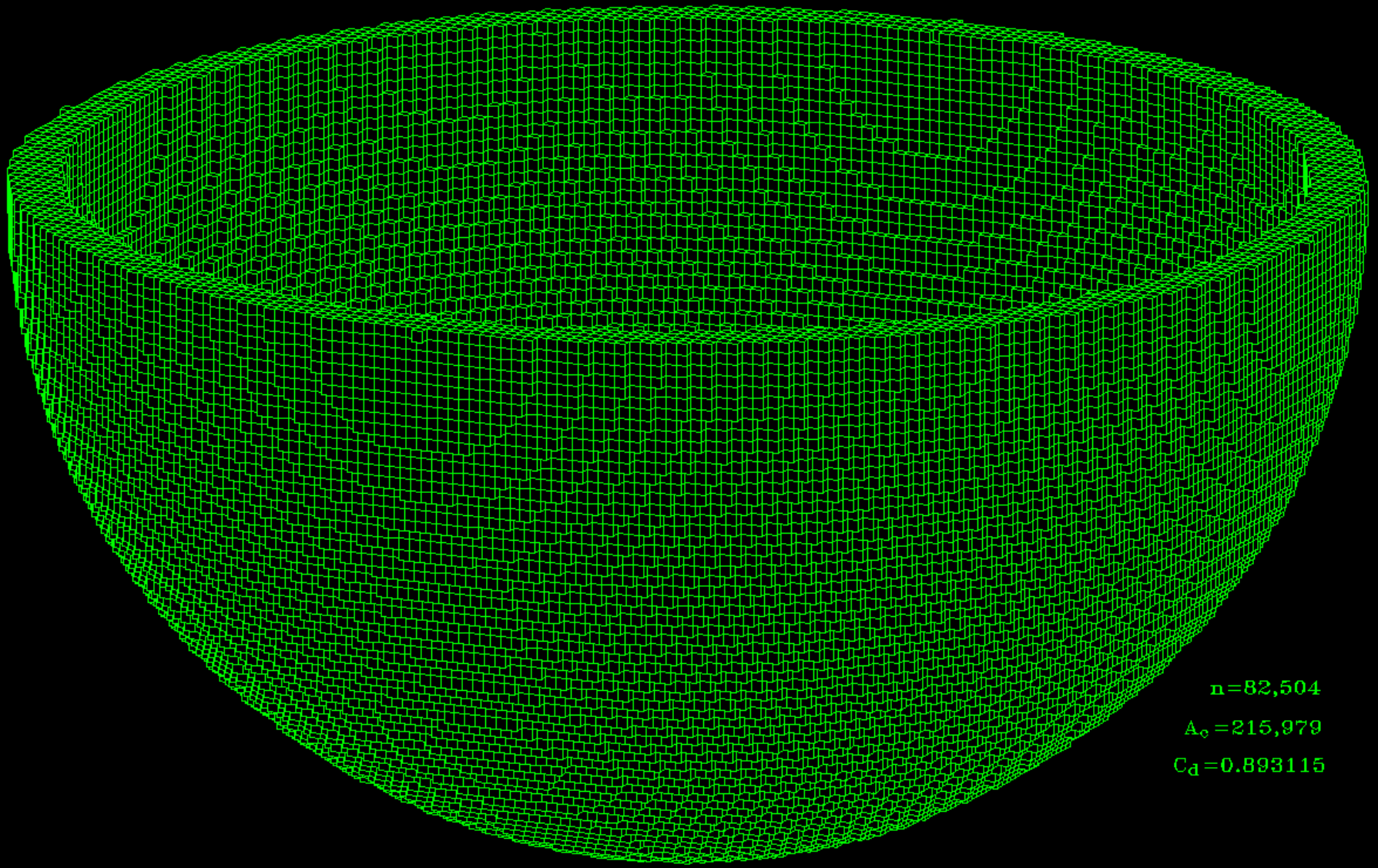

(f)
n=925
A c=159
C d=0.063850

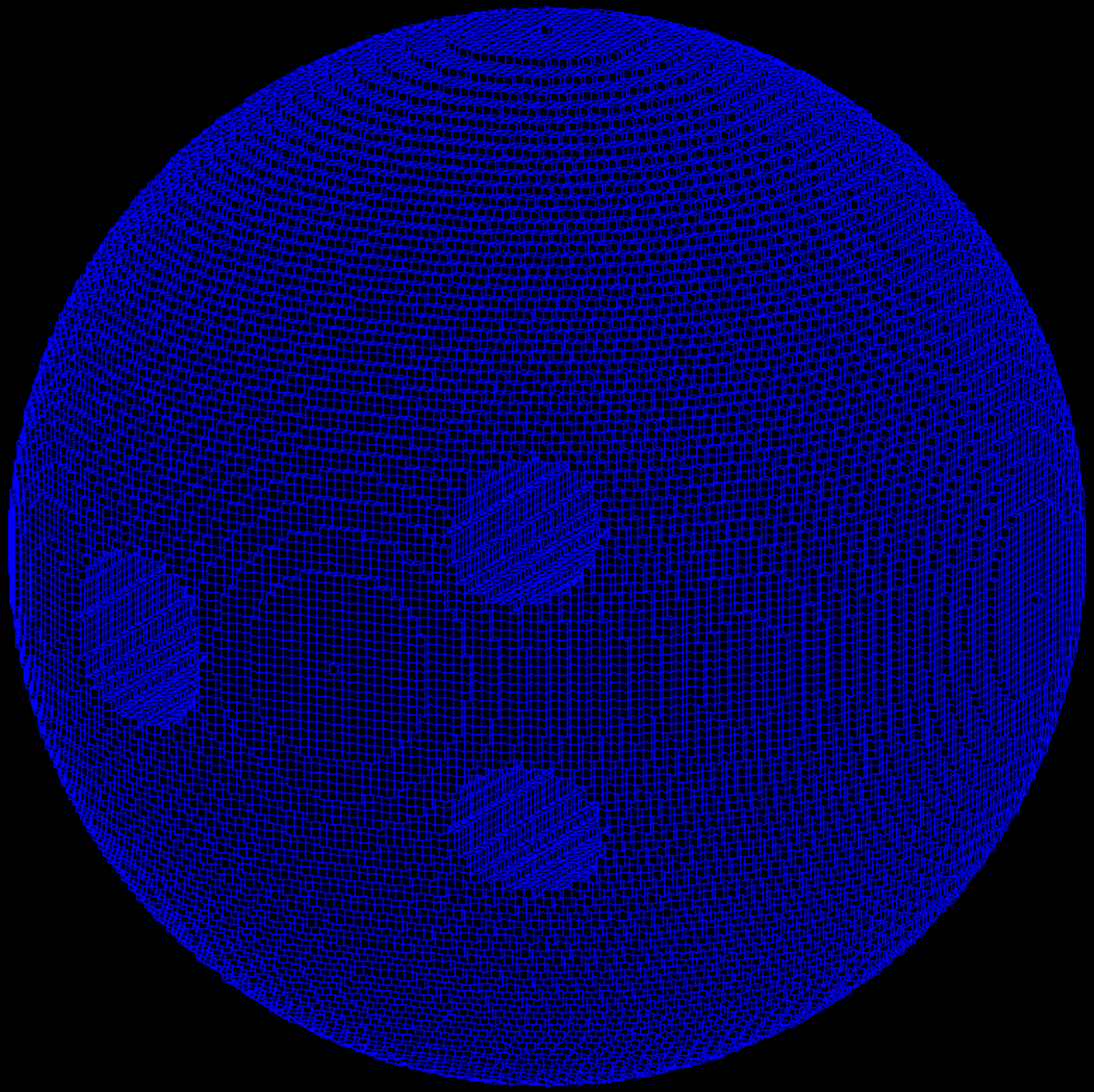


n=860,079

A_c=2,547,498

C_d=0.997803

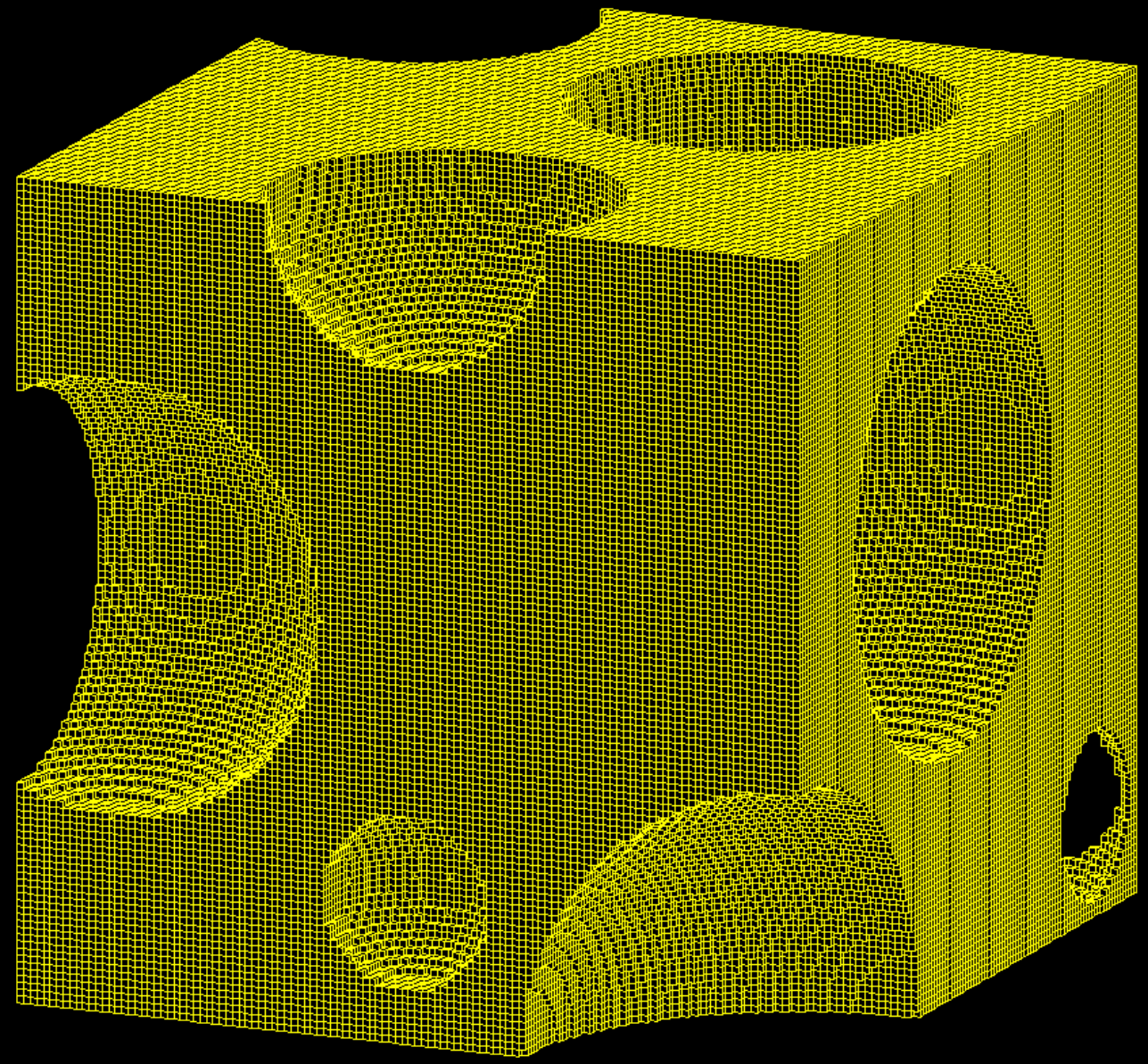

n=82,504
A_c=215,979
C_d=0.893115



$n = 785{,}816$

$A_c = 2{,}314{,}538$

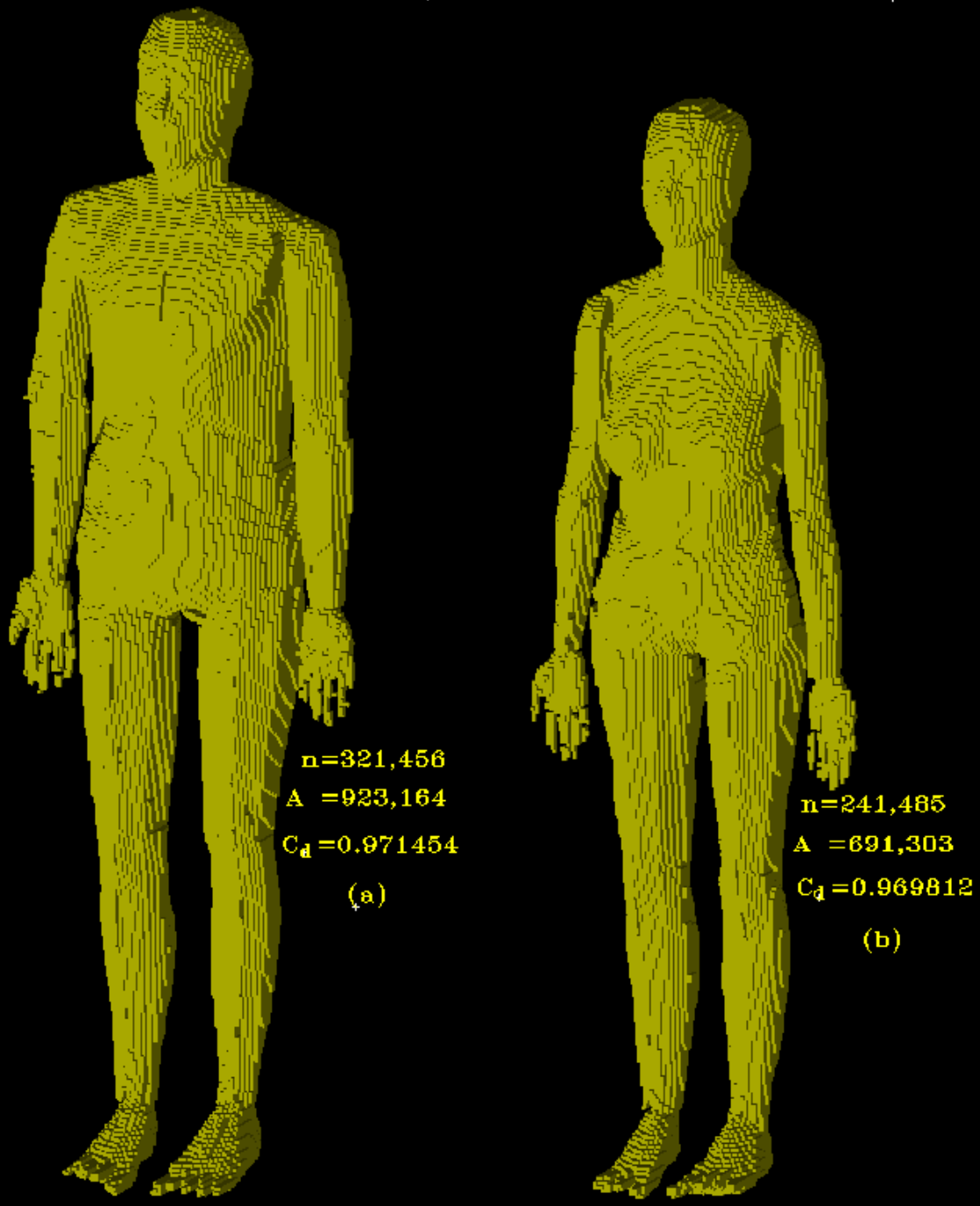
$C_d = 0.992554$



$n = 1{,}311{,}676$

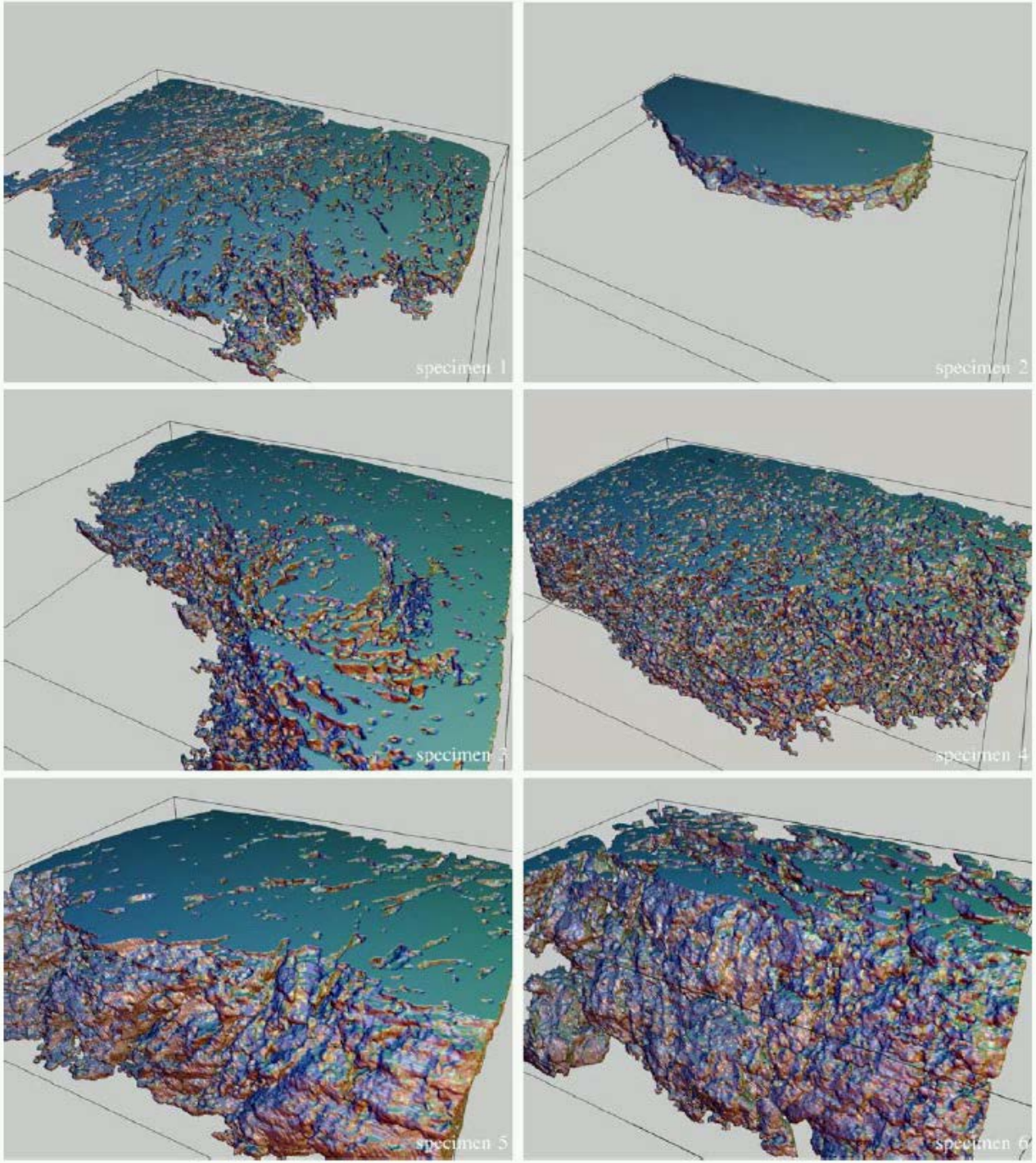
$A_c = 3{,}847{,}826$

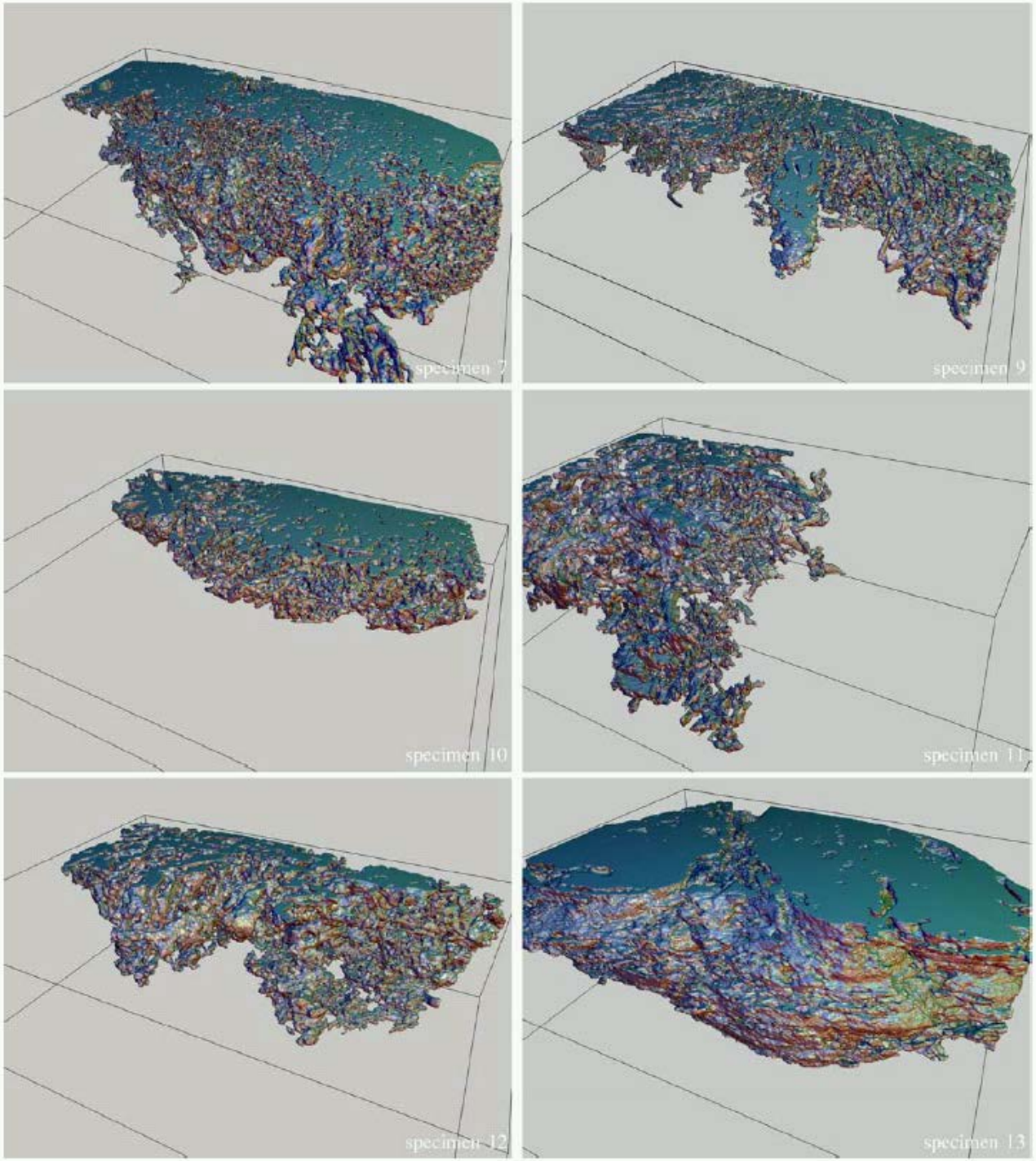
$C_d = 0.986854$

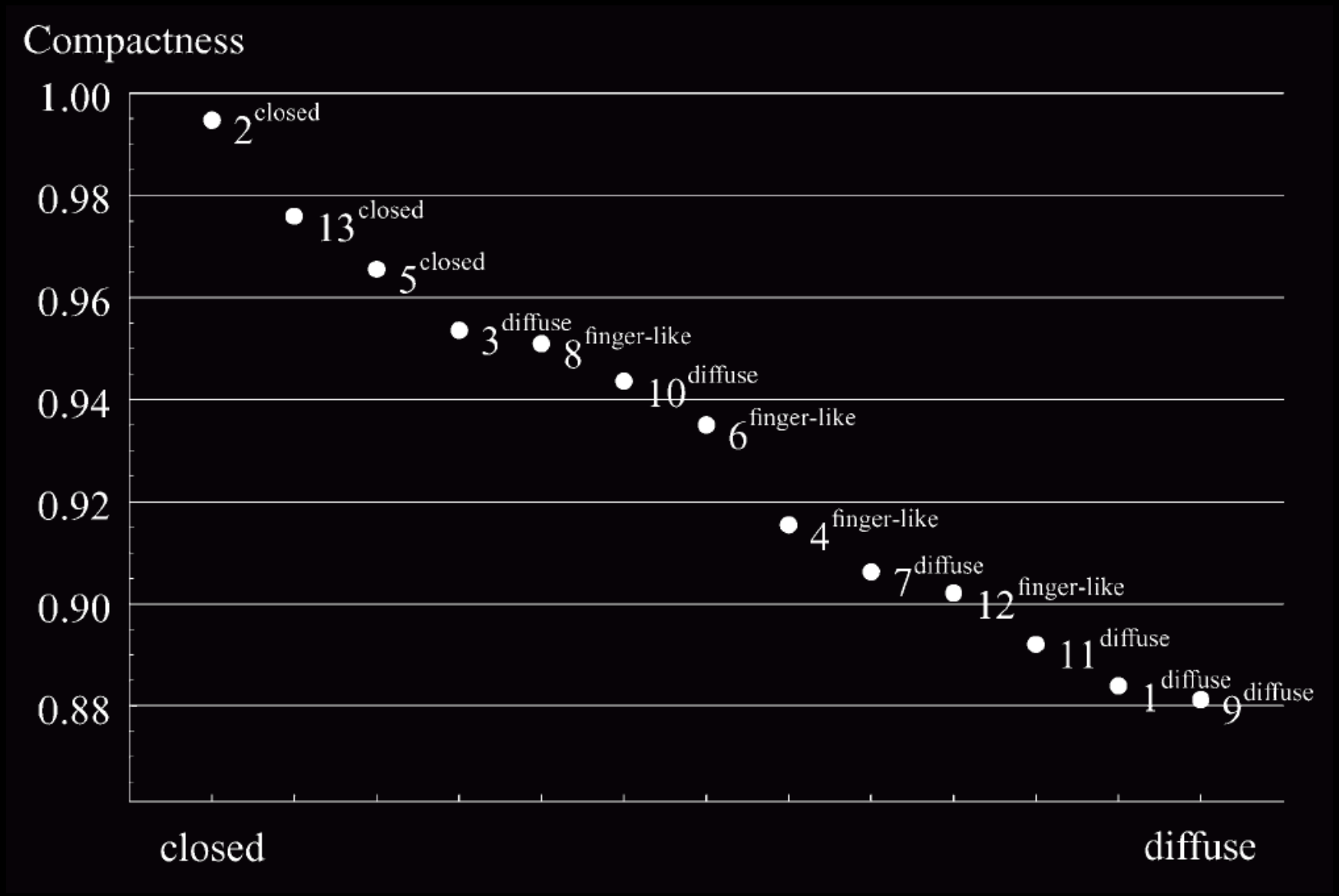

n=321,456
A =923,164
C_d =0.971454
(a)
n=241,485
A =691,303
C_d =0.969812
(b)

Three-Dimensional Reconstruction and Quantification of Cervical Carcinoma Invasion Fronts From Histological Serial Sections

Ulf-Dietrich Braumann, *Member, IEEE*, Jens-Peer Kuska, *Member, IEEE*, Jens Einenkel, Lars-Christian Horn, Markus Löffler, and Michael Höckel


specimen 1
specimen 2
specimen 3
specimen 4
specimen 5
specimen 6


specimen 7
specimen 9
specimen 10
specimen 11
specimen 12
specimen 13


Compactness
1.00
0.98
0.96
0.94
0.92
0.90
0.88
2 closed
13 closed
5 closed
3 diffuse
8 finger-like
10 diffuse
6 finger-like
4 finger-like
7 diffuse
12 finger-like
11 diffuse
1 diffuse
9 diffuse
closed
diffuse

A Voxel-Based Measure of Discrete Compactness for Brain Imaging

E. Bribiesca[1,2], J. R. Jimenez[1], V. Medina[1], R. Valdes[1], O. Yanez[1]
[1]Department of Electrical Engineering, Universidad Autonoma Metropolitana, Iztapalapa, Mexico
[2]In sabbatical leave at [1], Mailing Address: Department of Computer Science, IIMAS, Universidad Nacional Autonoma de Mexico, Apdo. 20-726, Mexico, D.F. 01000 email: ernesto@leibniz.iimas.unam.mx

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Pattern Recognition 41 (2008) 543–554

PATTERN RECOGNITION
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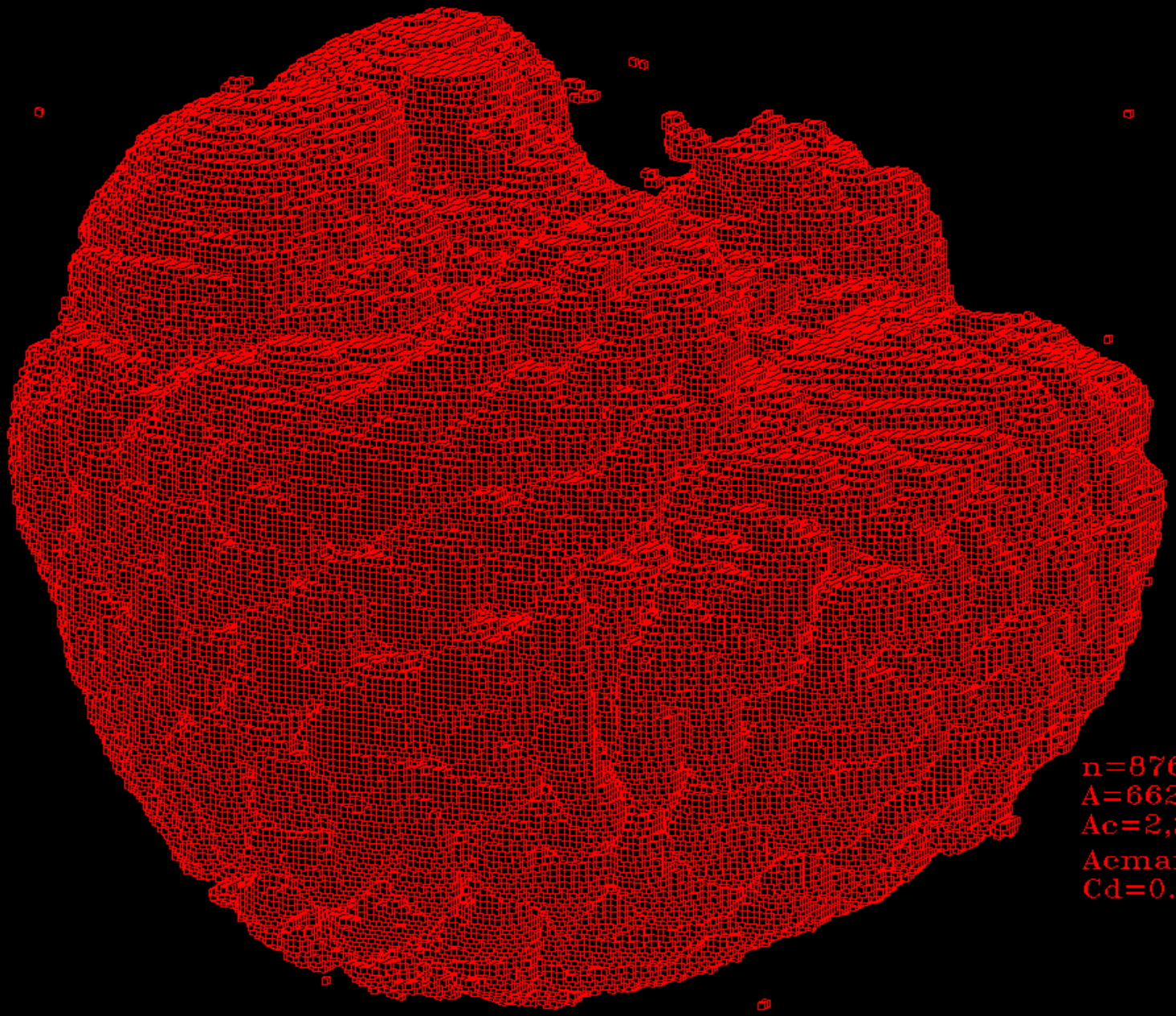
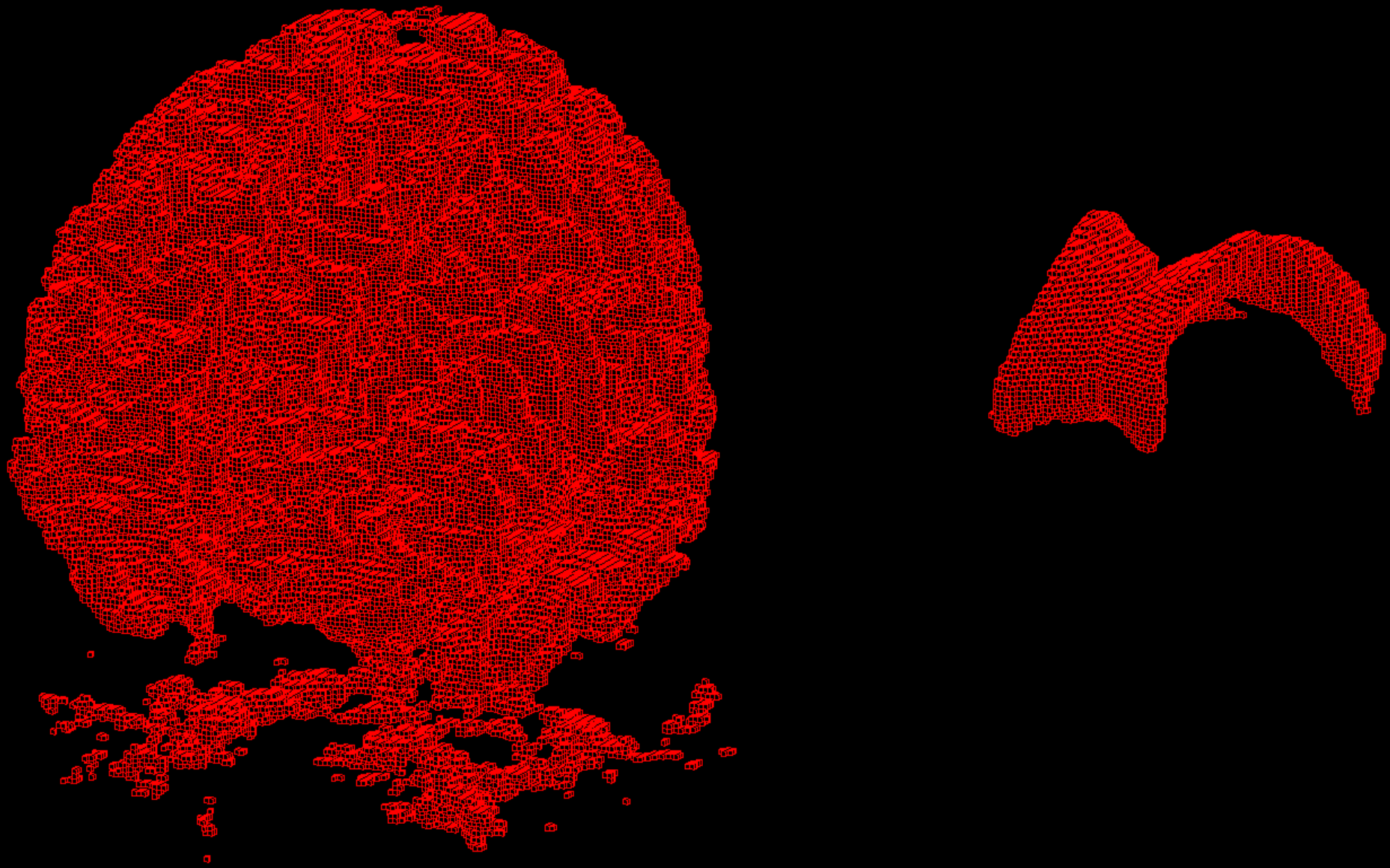
An easy measure of compactness for 2D and 3D shapes

Ernesto Bribiesca*

Departamento de Ciencias de la Computación, Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas, Universidad Nacional Autónoma de México, Apdo. Postal 20-726, D.F., 01000, México


n=876,467 voxels
A=662,672
Ac=2,298,065
Acmax=2,601,927
Cd=0.8238
UAM-UNAM



Proceedings of the 29th Annual International
Conference of the IEEE EMBS
Cité Internationale, Lyon, France
August 23-26, 2007.

Shape Characterization of Extracted and Simulated Tumor Samples using Topological and Geometric Measures

Markus Rohrschneider*, Gerik Scheuermann*, Stefan Hoehme†, Dirk Drasdo‡

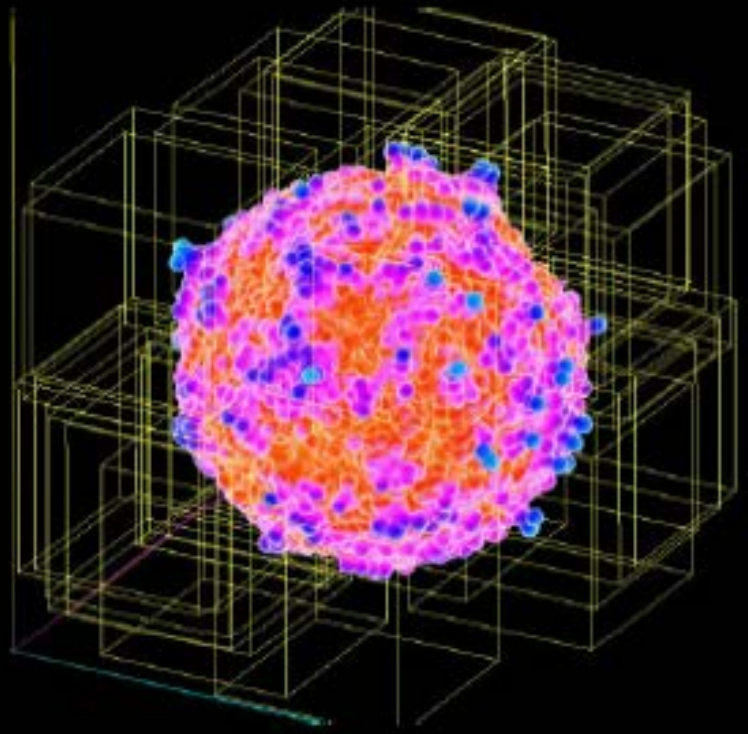


Fig. 2. Boundary of simulated tumor sample id120_mot1. The bounding boxes of 30 random samples are shown.

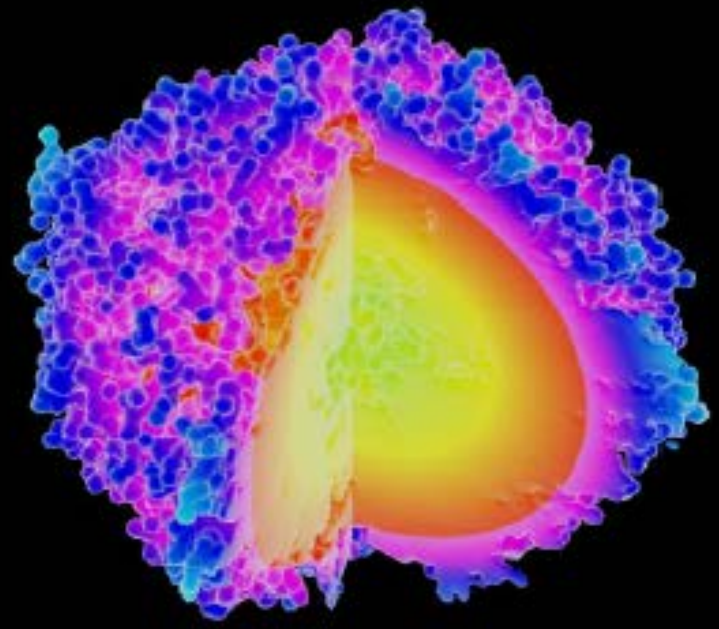


Fig. 3. Boundary of simulated tumor sample id100_mot30. The inner surface due to the necrotic core is shown.

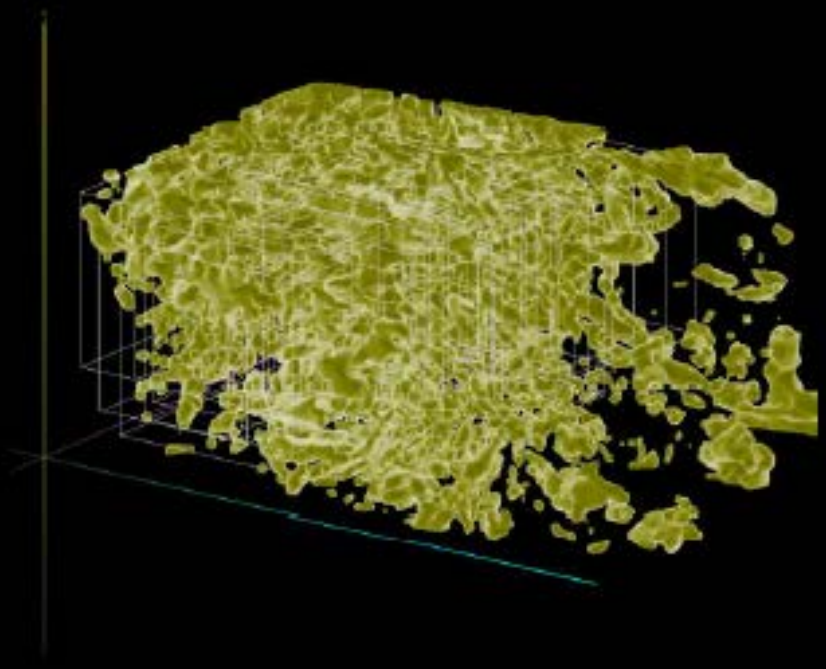


Fig. 6. Boundary of cervix carcinoma specimen 11 (diffuse tumor type). The bounding boxes of 30 random samples containing approx. 13% foreground voxels, are shown.

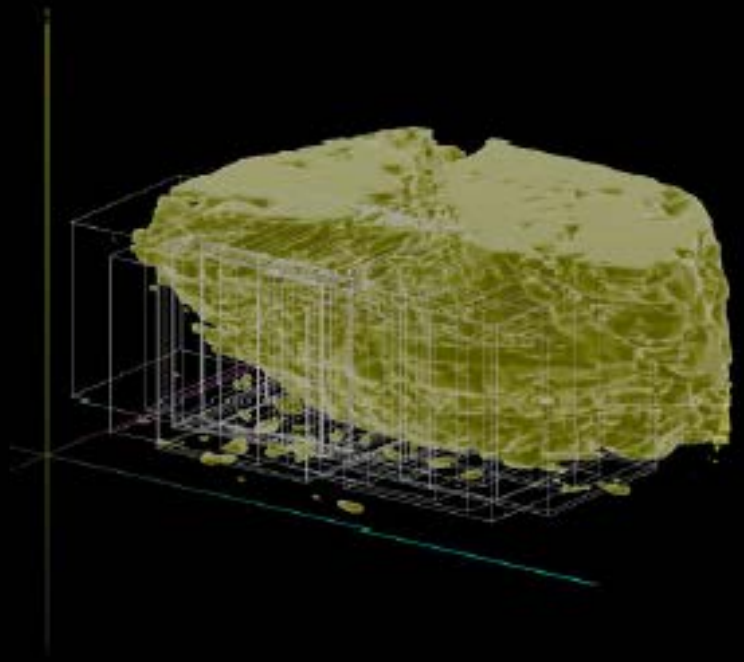


Fig. 7. Boundary of cervix carcinoma specimen 13 (compact tumor type). The bounding boxes of 30 random samples containing approx. 27% foreground voxels, are shown. The object contains many small cavities not visible in this representation.

TABLE I

RESULTS OF THE COMPACTNESS COMPUTATION AND TOPOLOGICAL ANALYSIS.

Dataset	Average of 30 Samples							Complete Object				
	Area	Volume	Compactness		β_0	β_1	β_2	Compactness		β_0	β_1	β_2
1. asym_mot1	15618.5	198596	0.85	0.9876	1.00	11.01	0.00	6.67	0.9929	1	176	0
2. asym_mot20	28815.9	192697	5.70	0.9717	1.07	33.03	0.00	60.41	0.9773	2	624	0
3. id095_mot1	27406.1	199477	4.57	0.9750	1.43	40.08	0.00	36.86	0.9809	6	468	0
4. id100_mot1	24598.7	190235	3.64	0.9766	1.33	35.39	0.00	28.55	0.9835	5	475	0
5. id100_mot10	33698.5	189090	9.46	0.9662	1.37	43.27	0.00	74.92	0.9723	5	475	0
6. id100_mot20	34658.0	185317	10.72	0.9647	1.07	40.03	0.00	100.39	0.9688	2	447	0
7. id100_mot30	46132.2	184418	25.53	0.9507	1.00	288.88	1.59	254.65	0.9564	1	2867	17
8. id100_mot1_adh	32872.8	195883	8.19	0.9680	1.03	101.50	0.00	66.16	0.9768	2	1301	0
9. id120_mot1	18581.0	200296	1.41	0.9844	1.00	24.27	0.00	10.76	0.9903	1	316	0
10. cerv11 (diffuse type)	89644.6	134022	354.66	0.8800	110.43	101.11	0.75	3337.46	0.8742	934	618	5
11. cerv13 (compact type)	55138.9	273947	19.75	0.9601	50.37	106.11	36.41	114.21	0.9758	334	1284	755

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Evaluation of the invasion front pattern of squamous cell cervical carcinoma by measuring classical and discrete compactness

Jens Einenkel[a], Ulf-Dietrich Braumann[b], Lars-Christian Horn[c], Nadine Pannicke[a], Jens-Peer Kuska[b], Alexander Schütz[c], Bettina Hentschel[d], Michael Höckel[a]

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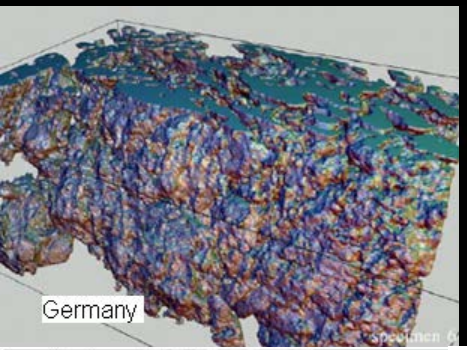
Abstract

The invasion front pattern of squamous cell carcinoma (SCC) is a conspicuous histological phenomenon, which is assessed without precise criteria. The current study was performed to introduce the classical (C_C) and discrete compactness (C_D) as new morphometric parameters for quantification of this pattern. A retrospective analysis of 76 surgically treated patients with cervical carcinoma was conducted and the pattern of invasion was qualitatively classified as *closed*, *finger-like* or *diffuse*, respectively, by two pathologists. After digitization of the histological slides with a field of view of 10.4 mm × 8.3 mm, tumor areas were labeled and C_C and C_D were computed based on the drawings (binary images). Additionally, intraindividual variation of compactness was evaluated for 12 selected tumors. The qualitative pattern assessment by the pathologists was moderately reproducible with an interobserver agreement of 72% and a κ coefficient of 0.44. The values of C_C and C_D referring to the invasion front patterns assigned by both pathologists were significantly different between the three classified groups ($p \leq 0.01$ and $p \leq 0.0001$), so that, both theoretically and in practice, compactness regards the same morphological feature. In due consideration of the analysis of the area under the ROC (receiver operating characteristic) curves and the variation coefficient of different tumor regions, C_D is more suitable for practical use than C_C. Tumors with a microscopic invasion into the parametria and with lymph-vascular space invasion were found to have a lower value of C_D, which indicates a more *diffuse* pattern of invasion ($p = 0.028$ and $p = 0.033$). We conclude that the discrete compactness C_D is a new and reproducible parameter for a computer assisted quantification of the invasion front pattern and, thus, defines a further phenotypic feature of SCC of the uterine cervix.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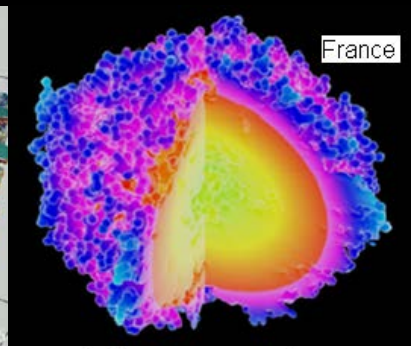
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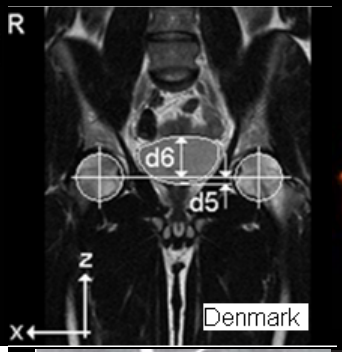
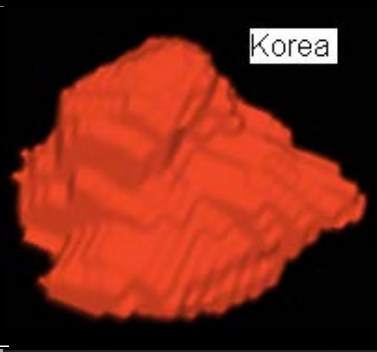

R
d6
d5
z
x
Denmark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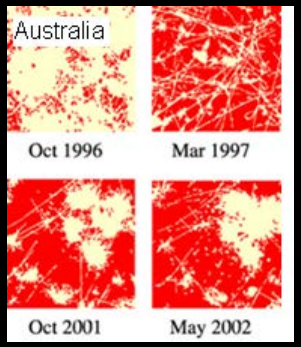
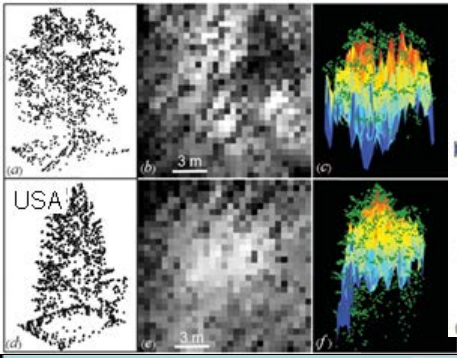
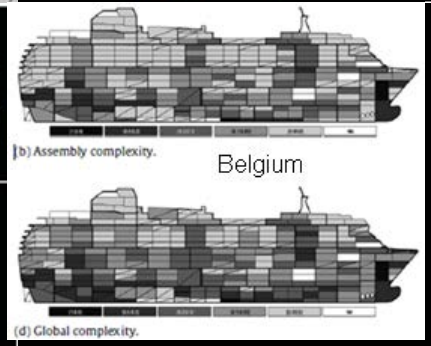
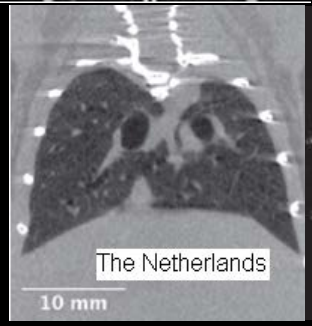
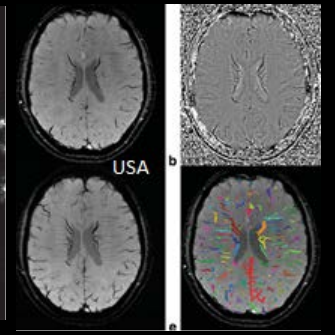

Australia
Oct 1996
Mar 1997
Oct 2001
May 2002


3 m
USA
3 m


(b) Assembly complexity.
Belgium
(d) Global complexity.


The Netherlands
10 mm


United Kingdom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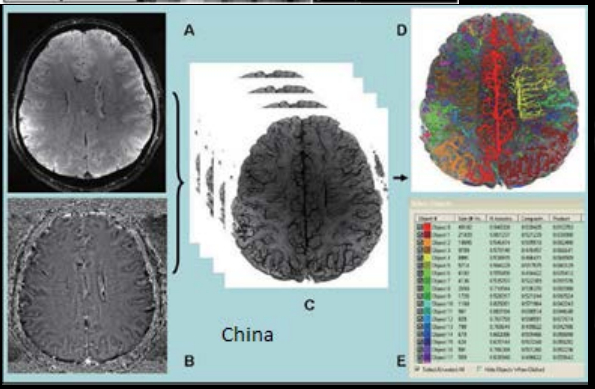
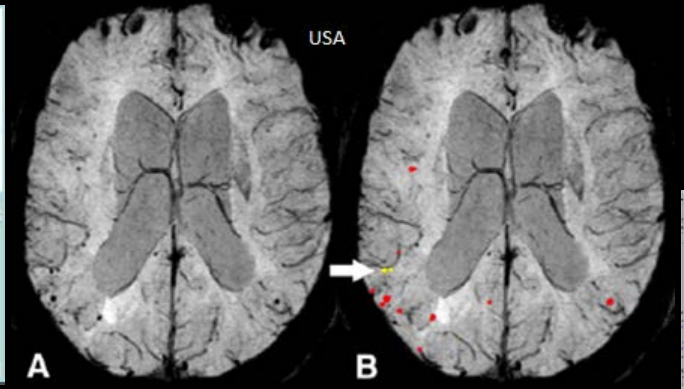
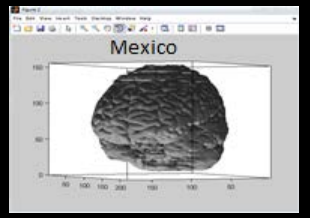
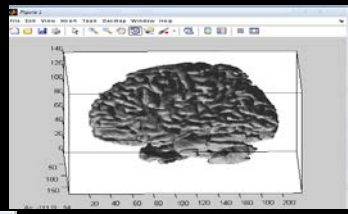
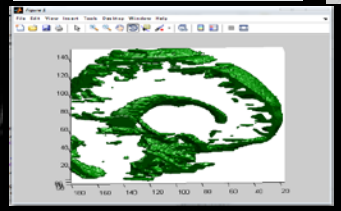
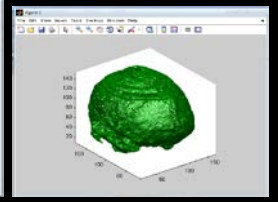

A
D
C
China
B
E


USA
A
B


Mexico







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How to Maximize the Contact Perimeter and Contact Area of Shapes Composed of Cells in the Discrete Domain

Carlos Velarde

Department of Computer Science
Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas
Universidad Nacional Autónoma de México
Apdo. 20-726, México, D.F., 01000

Ernesto Bribiesca[1]

Department of Computer Science
Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas
Universidad Nacional Autónoma de México
Apdo. 20-726, México, D.F., 01000

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(71) Applicant (*for all designated States except US*): **SIEMENS CORPORATE RESEARCH, INC.** [US/US]; 755 College Road East, Princeton, New Jersey 08540 (US).

(72) Inventors; and

(75) Inventors/Applicants (*for US only*): **CHARLIN, Laurent** [CA/US]; 915 Mount Lucas, Princeton, New Jersey 08540 (US). **ZHANG, Li** [CN/US]; 14 Bronson Way, Skillman, New Jersey 08558 (US).

(74) Agents: **PASCHBURG, Donald B.** et al.; Siemens Corporation- Intellectual Property Dept., 170 Wood Avenue South, Iselin, New Jersey 08830 (US).

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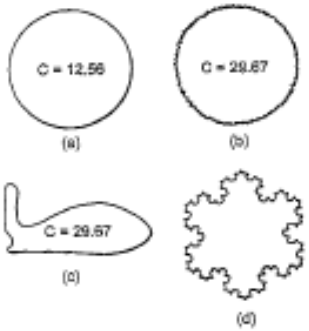
[Continued on next page]

(54) Title: SYSTEM AND METHOD FOR CHARACTERIZING 2-DIMENSIONAL SHAPES BY COMPACTNESS MEASUREMENTS



Sample segmented nodule at original size

(57) Abstract: A method of classifying a shape in a digitized image includes determining a normalized compactness CDN for an object in said image from the formula , wherein T is the connectivity of the object, n is the number of pixels in the object, and P is the length of the perimeter of the object, and classifying said object based on its normalized compactness value

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