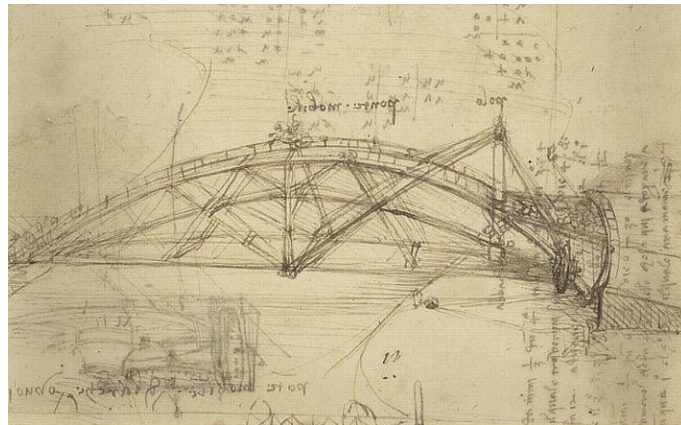# Suitably impressive title

Your Name

Nonlinear Solid Mechanics and Structures Group
(GAMOSINOS)

Universidad Politécnica de Madrid
Escuela Técnica Superior de Ingeniería Aeronáutica y del Espacio

A project submitted for the degree of
Aeronautics and Space Engineer

2022

"Thanks to my solid academic training, today I can write hundreds of words on virtually any topic without possessing a shred of information, which is how I got a good job in journalism."

Dave Barry

Acknowledgements

Personal

This is where you thank your advisor, colleagues, and family and friends.

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Vestibulum feugiat et est at accumsan. Praesent sed elit mattis, congue mi sed, porta ipsum. In non ullamcorper lacus. Quisque volutpat tempus ligula ac ultricies. Nam sed erat feugiat, elementum dolor sed, elementum neque. Aliquam eu iaculis est, a sollicitudin augue. Cras id lorem vel purus posuere tempor. Proin tincidunt, sapien non dictum aliquam, ex odio ornare mauris, ultrices viverra nisi magna in lacus. Fusce aliquet molestie massa, ut fringilla purus rutrum consectetur. Nam non nunc tincidunt, rutrum dui sit amet, ornare nunc. Donec cursus tortor vel odio molestie dignissim. Vivamus id mi erat. Duis porttitor diam tempor rutrum porttitor. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed condimentum venenatis consectetur. Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Aenean sit amet lectus nec tellus viverra ultrices vitae commodo nunc. Mauris at maximus arcu. Aliquam varius congue orci et ultrices. In non ipsum vel est scelerisque efficitur in at augue. Nullam rhoncus orci velit. Duis ultricies accumsan feugiat. Etiam consectetur ornare velit et eleifend.

Institutional

If you want to separate out your thanks for funding and institutional support, I don't think there's any rule against it. Of course, you could also just remove the subsections and do one big traditional acknowledgement section.

Abstract

Your abstract text goes here. Check your departmental regulations, but generally this should be less than 300 words.

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Pellentesque sit amet nibh volutpat, scelerisque nibh a, vehicula neque. Integer placerat nulla massa, et vestibulum velit dignissim id. Ut eget nisi elementum, consectetur nibh in, condimentum velit. Quisque sodales dui ut tempus mattis. Duis malesuada arcu at ligula egestas egestas. Phasellus interdum odio at sapien fringilla scelerisque. Mauris sagittis eleifend sapien, sit amet laoreet felis mollis quis. Pellentesque dui ante, finibus eget blandit sit amet, tincidunt eu neque. Vivamus rutrum dapibus ligula, ut imperdiet lectus tincidunt ac. Pellentesque ac lorem sed diam egestas lobortis.

Suspendisse leo purus, efficitur mattis urna a, maximus molestie nisl. Aenean porta semper tortor a vestibulum. Suspendisse viverra facilisis lorem, non pretium erat lacinia a. Vestibulum tempus, quam vitae placerat porta, magna risus euismod purus, in viverra lorem dui at metus. Sed ac sollicitudin nunc. In maximus ipsum nunc, placerat maximus tortor gravida varius. Suspendisse pretium, lorem at porttitor rhoncus, nulla urna condimentum tortor, sed suscipit nisi metus ac risus.

Aenean sit amet enim quis lorem tristique commodo vitae ut lorem. Duis vel tincidunt lacus. Sed massa velit, lacinia sed posuere vitae, malesuada vel ante. Praesent a rhoncus leo. Etiam sed rutrum enim. Pellentesque lobortis elementum augue, at suscipit justo malesuada at. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Praesent rhoncus convallis ex. Etiam commodo nunc ex, non consequat diam consectetur ut. Pellentesque vitae est nec enim interdum dapibus. Donec dapibus purus ipsum, eget tincidunt ex gravida eget. Donec luctus nisi eu fringilla mollis. Donec eget lobortis diam.

Suspendisse finibus placerat dolor. Etiam ornare elementum ex ut vehicula. Donec accumsan mattis erat. Quisque cursus fringilla diam, eget placerat neque bibendum eu. Ut faucibus dui vitae dolor porta, at elementum ipsum semper. Sed ultrices dui non arcu pellentesque placerat. Etiam posuere malesuada turpis, nec malesuada tellus malesuada.

Contents

List of Figures

x

List of Tables

Listings

List of Algorithms

List of Symbols

α . . . . Coefficient spatial dimensions in an image.

λ . . . . Variable.

μ . . . . Constant.

List of Abbreviations

1-D, 2-D . . . One- or two-dimensional, referring in this thesis to spatial dimensions in an image.

Otter . . . . . One of the finest of water mammals.

Hedgehog . . . Quite a nice prickly friend.

xx

Neque porro quisquam est qui dolorem ipsum quia dolor sit amet, consectetur, adipisci velit...

There is no one who loves pain itself, who seeks after it and wants to have it, simply because it is pain...

— Cicero's *de Finibus Bonorum et Malorum*

1

Introduction

Contents

1.1 Motivation

The body of the project should have, apart from the title, abstract and tables of content:

- Title page. Your department will have a standard title page form you are required to follow. The title should be informative, contain keywords, and

reveal the topic of the thesis. Include the title, author, thesis supervisor, place, and date.

- Abstract. Briefly state the (1) research problem, (2) methodology, (3) key results, and (4) conclusion. Generally, abstracts are between 100 and 150 words–roughly 5-10 sentences.

- (What others do?) Chapter 1: Introduction. State (1) the purpose of the investigation, (2) the problem being investigated, (3) the background (context and importance) of the problem (citing previous work by others), (4) your thesis and general approach, and (5) the criteria for your study's success.

- (What I do?) Chapter 2: Theoretical framework. Develop the theoretical basis for your design or experimental work, including any governing equations. Detailed calculations go to an appendix.

- (How I do it?) Chapter 3: Methodology. List and describe key materials and apparatus. Then describe the procedure in enough detail that others can duplicate it. For design studies, this section includes component design, fabrication, assembly, and testing procedures. Use illustrations.

- (What I get?) Chapter 4: Results. Present the results, usually with accompanying tables and graphs. Characterize the patterns and quality of the results and estimate their accuracy and precision. Detailed data go to an appendix. Use analytical graphics.

- (How I interpret what I get? What I'll to extend this work?) Chapter 5: Discussion, conclusions and future work. Discuss the meaning of the results, stating clearly what their significance is. Compare the results with theoretical expectations and account for anything unexpected.

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Maecenas sagittis dolor at nulla feugiat, vitae iaculis est rutrum. Mauris eu sem eros. Sed id faucibus urna. In egestas eros et sapien egestas imperdiet. In hac habitasse platea dictumst.

Name author, November 22, 2021

For larger chunks, like this paragraph or indeed entire figures, you can use the `mccorrection` environment. This environment highlights paragraph-sized and larger blocks with the same blue colour.

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Maecenas sagittis dolor at nulla feugiat, vitae iaculis est rutrum. Mauris eu sem eros. Sed id faucibus urna. In egestas eros et sapien egestas imperdiet. In hac habitasse platea dictumst.

1.2   Equations

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Maecenas sagittis dolor at nulla feugiat, vitae iaculis est rutrum. Mauris eu sem eros. Sed id faucibus urna. In egestas eros et sapien egestas imperdiet. In hac habitasse platea dictumst. Phasellus vitae varius tortor. Mauris nec sollicitudin enim. Suspendisse molestie leo nec mauris molestie, nec imperdiet magna vehicula. Phasellus sodales tortor dui, a lacinia turpis congue at. Pellentesque mattis dui non libero commodo, at accumsan ex ultrices. Integer eget ex eget dui cursus euismod et accumsan felis. Nullam laoreet sodales dui, ut finibus elit varius a. Sed elementum orci quis libero ullamcorper, eget egestas enim convallis. Sed nibh libero, tincidunt ultricies nibh quis, lobortis placerat mauris. Maecenas at laoreet risus, nec dictum libero. Donec accumsan, orci eu tempus mattis, nisl arcu auctor turpis, ac sollicitudin justo orci nec nulla.

$$\boldsymbol{n}_1^{\otimes d} = \tfrac{1}{2} \begin{bmatrix} \tfrac{1}{3} - \cos 2\psi & \sin 2\psi & 0 \\ \sin 2\psi & \tfrac{1}{3} + \cos 2\psi & 0 \\ 0 & 0 & -\tfrac{2}{3} \end{bmatrix} \tag{1.1}$$

1.3   Algorithms

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Maecenas sagittis dolor at nulla feugiat, vitae iaculis est rutrum. Mauris eu sem eros. Sed id faucibus urna. In egestas eros et sapien egestas imperdiet. In hac habitasse platea dictumst. Phasellus vitae varius tortor. Mauris nec sollicitudin enim. Suspendisse molestie leo nec mauris molestie, nec imperdiet magna vehicula. Phasellus sodales tortor dui, a

---

Algorithm 1 Calculate $y = x^n$

Require: $n \geq 0 \vee x \neq 0$
Ensure: $y = x^n$
  $y \leftarrow 1$
  if $n < 0$ **then**
    $X \leftarrow 1/x$
    $N \leftarrow -n$
  else
    $X \leftarrow x$
    $N \leftarrow n$
  end if
  while $N \neq 0$ **do**
    if N is even **then**
      $X \leftarrow X \times X$
      $N \leftarrow N/2$
    else $\{N$ is odd$\}$
      $y \leftarrow y \times X$
      $N \leftarrow N - 1$
    end if
  end while

---

lacinia turpis congue at. Pellentesque mattis dui non libero commodo, at accumsan ex ultrices. Integer eget ex eget dui cursus euismod et accumsan felis. Nullam laoreet sodales dui, ut finibus elit varius a. Sed elementum orci quis libero ullamcorper, eget egestas enim convallis. Sed nibh libero, tincidunt ultricies nibh quis, lobortis placerat mauris. Maecenas at laoreet risus, nec dictum libero. Donec accumsan, orci eu tempus mattis, nisl arcu auctor turpis, ac sollicitudin justo orci nec nulla.

1.4 Python code

```python
import numpy as np

def incmatrix(genl1,genl2):
    m = len(genl1)
    n = len(genl2)
    M = None #to become the incidence matrix
    VT = np.zeros((n*m,1), int)  #dummy variable

    #compute the bitwise xor matrix
    M1 = bitxormatrix(genl1)
    M2 = np.triu(bitxormatrix(genl2),1)
```

```
12
13    for i in range(m-1):
14        for j in range(i+1, m):
15            [r,c] = np.where(M2 == M1[i,j])
16            for k in range(len(r)):
17                VT[(i)*n + r[k]] = 1;
18                VT[(i)*n + c[k]] = 1;
19                VT[(j)*n + r[k]] = 1;
20                VT[(j)*n + c[k]] = 1;
21
22                if M is None:
23                    M = np.copy(VT)
24                else:
25                    M = np.concatenate((M, VT), 1)
26
27                VT = np.zeros((n*m,1), int)
28
29    return M
```

Listing 1.1: Python example

Nam eget sem sed ligula vehicula iaculis. In non arcu a nisl interdum gravida. Nam egestas erat non turpis sagittis vestibulum. Praesent est metus, facilisis eu commodo sed, sagittis et est. Duis scelerisque luctus erat, elementum pulvinar felis bibendum a. Morbi hendrerit rhoncus consectetur. Vestibulum nec odio finibus, blandit turpis eget, dignissim orci. Curabitur eu ligula auctor, porttitor nulla non, maximus turpis. Nunc sed quam at est varius interdum eu vitae odio. Vestibulum egestas dapibus nulla sit amet fermentum.

Vestibulum ut neque urna. Ut nec odio lobortis, ultricies nulla quis, ultricies tellus. Nam ac iaculis sapien. Vivamus vitae risus id tortor interdum pellentesque. Quisque lorem lectus, sagittis vel metus et, sagittis finibus justo. Curabitur pulvinar odio tellus, eu vehicula est dictum eget. Morbi sed justo justo. Vivamus enim nibh, facilisis pretium luctus quis, ullamcorper quis ipsum. Pellentesque a mi a elit euismod malesuada.

1.5   Julia code

```
1  #= This is a code sample for the Julia language
2  (adapted from http://julialang.org) =#
```

```julia
3  function mandel(z)
4      c = z
5      maxiter = 80
6      for n = 1:maxiter
7          if abs(z) > 2
8              return n-1
9          end
10         z = z^2 + c
11     end
12     return maxiter
13 end
14
15 function helloworld()
16     println("Hello, World!") # Bye bye, MATLAB!
17 end
18
19 function randmatstat(t)
20     n = 5
21     v = zeros(t)
22     w = zeros(t)
23     for i = 1:t
24         a = randn(n,n)
25         b = randn(n,n)
26         c = randn(n,n)
27         d = randn(n,n)
28         P = [a b c d]
29         Q = [a b; c d]
30         v[i] = trace((P.'*P)^4)
31         w[i] = trace((Q.'*Q)^4)
32     end
33     std(v)/mean(v), std(w)/mean(w)
34 end
```

Listing 1.2: Julia example

Vestibulum interdum est vel orci tincidunt auctor. Nunc tristique nulla nec blandit fermentum. Maecenas id libero ut justo dictum sodales. Nullam justo sapien, dignissim vel enim at, porta pharetra metus. Integer euismod quam eget ligula gravida euismod. Pellentesque commodo, quam sit amet bibendum tempor, nisi odio varius mauris, et accumsan justo ex sed nunc. Cras bibendum nibh ac dolor volutpat, non elementum orci pulvinar. Maecenas et porttitor nulla. Suspendisse sapien massa, dapibus at blandit et, rhoncus suscipit velit. Fusce molestie, velit eget sagittis suscipit, est libero aliquam libero, in iaculis mi tellus ac nunc.

1.6   Matlab code

```matlab
for i = 1:3
    if i >= 5                        % literate programming
    replacement
        disp('cool');                % comment with some
    mcommentfont
      end
    [~,ind] = max(vec);
    x_last = x(1,end);
    v(end);
    really really long really really long really really
    long really really long really really long line %
    blaaaaaaaa
end
```

Listing 1.3: Matlab example

Sed in rhoncus lectus. Mauris vulputate purus non malesuada pulvinar. Curabitur ullamcorper hendrerit elit, id vulputate libero sagittis vel. Pellentesque ac faucibus est. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos himenaeos. Integer venenatis, nisl eleifend pellentesque consequat, sem tortor malesuada ante, ut tincidunt elit tortor sit amet nunc.

Cras vehicula ipsum sit amet dui rutrum ultrices. Integer eu eleifend odio. Praesent tempor, libero id ullamcorper euismod, lectus diam lobortis mauris, id venenatis arcu sem vitae purus. Pellentesque luctus tristique metus quis mollis. Praesent ullamcorper neque velit, sed iaculis est convallis sit amet. Quisque nec massa ut magna lobortis imperdiet. Quisque rhoncus purus eget mollis aliquet. Donec vehicula viverra nisl, sed posuere turpis vulputate non. Donec malesuada, eros id interdum volutpat, ipsum orci luctus quam, non pulvinar urna ipsum eget purus. Nam hendrerit condimentum tristique. Proin metus velit, tempor at fringilla non, dictum eu felis.

1.7   OpenScad code (3D design)

```openscad
$fn=6;
marg=0.98;
//draw segment between 2 specified points
```

```
4  module rod(p1,p2,r){
5      translate((p1+p2)/2)
6          rotate([-acos((p2[2]-p1[2]) / norm(p1-p2)),0,
7          -atan2(p2[0]-p1[0],p2[1]-p1[1])])
8              cylinder(r1=r, r2=r, h=norm(p1-p2), center=
    true);
9  }
10 //geometry definition
11 translate([-41,-101,28])
12     sphere(r=0.202);
13 rod([-41,-101,28],[-41,-101,31],marg*0.202);
14 rod([-41,-101,28],[-41,-98,28],marg*0.202);
15 rod([-41,-101,28],[-38,-101,28],marg*0.202);
```

Listing 1.4: OpenSCAD example.

Morbi eu lectus arcu. Sed fringilla dui ut magna commodo, a malesuada ante pellentesque. Donec ornare facilisis pellentesque. Nulla vitae fringilla velit. Nunc id tellus nisl. Maecenas pretium elit lectus, nec consectetur nunc vulputate et. Sed facilisis magna nec gravida hendrerit. Sed a cursus nisl, in rhoncus massa. Curabitur ut nibh interdum, tempor risus vel, scelerisque nibh. Mauris quis ipsum sed risus tempor convallis ut a eros.

1.8   BDF code. Used in Nastran

```
1  ID,WIRES,SIZ40
2  SOL,101
3  TIME,5
4  CEND
5  TITLE=GENERATIVE METAMATERIAL
6  SUBTITLE=CASE 1
7  LOAD=10
8  SPC=11
9  DISP=ALL
10 STRESS=ALL
11 STRAIN=ALL
12 ELFORCE=ALL
13 SPCFORCE=ALL
14 PARAM,BAILOUT,-1
15 BEGIN BULK
16 MDLPRM,HDF5,0
17
18 $ NODES COME HERE
```

```
19
20  GRID,1,,0.0,0.0,0.0
21  GRID,2,,0.0,10.0,0.0
22  GRID,3,,10.0,10.0,0.0
23  GRID,4,,10.0,0.0,0.0
24
25  $ ELEMENTS COME HERE
26
27  CBAR,1,11,1,2,1.0,0.0,0.0
28  CBAR,2,12,2,3,1.0,1.0,0.0
29  CBAR,3,13,3,4,1.0,0.0,0.0
30  CBAR,4,12,4,1,1.0,1.0,0.0
31
32  $ GEO/MECH PROPS COME HERE
33
34  PBARL,11,21,,BAR
35  ,0.75,0.75,,
36  PBARL,12,21,,BAR
37  ,0.8,0.8,,
38  PBARL,13,21,,BAR
39  ,0.84,0.84,,
40
41  MAT1,21,21e4,,0.3
42
43  $ BC AND LOADS COME HERE
44
45  FORCE,10,3,,15.0,0.0,0.0,-1.0
46
47  SPC1,11,123456,1
48  SPC1,11,123456,2
```

Listing 1.5: BDF example.

Morbi eu lectus arcu. Sed fringilla dui ut magna commodo, a malesuada ante pellentesque. Donec ornare facilisis pellentesque. Nulla vitae fringilla velit. Nunc id tellus nisl. Maecenas pretium elit lectus, nec consectetur nunc vulputate et. Sed facilisis magna nec gravida hendrerit. Sed a cursus nisl, in rhoncus massa. Curabitur ut nibh interdum, tempor risus vel, scelerisque nibh. Mauris quis ipsum sed risus tempor convallis ut a eros.

1.9 VTU code. Used in Paraview

```
1  <?xml version="1.0"?>
```

```
2   <VTKFile type="UnstructuredGrid">
3     <UnstructuredGrid>
4       <Piece NumberOfPoints="4"   NumberOfCells="4">
5         <Points>
6           <DataArray type="Float64" NumberOfComponents="
    3" format="ascii">
7  0.0       0.0        0.0
8  0.0       10.0       0.0
9  10.0      10.0       0.0
10 10.0      0.0        0.0
11          </DataArray>
12        </Points>
13        <Cells>
14            <DataArray type="Int32" Name="connectivity"
    format="ascii">
15 1 2
16 2 3
17 3 4
18 4 1
19          </DataArray>
20          <DataArray type="Int32" Name="offsets" format=
    "ascii">
21 2
22 4
23 6
24 8
25          </DataArray>
26          <DataArray type="UInt8" Name="types" format="
    ascii">
27 3
28 3
29 3
30 3
31          </DataArray>
32        </Cells>
33        <CellData>
34          <DataArray type="Float64" Name="Radius"
    NumberOfComponents="1" format="ascii">
35 0.1
36 0.2
37 0.3
38 0.4
39          </DataArray>
40          <DataArray type="Float64" Name="Young Modulus"
     NumberOfComponents="1" format="ascii">
```

```
41 100
42 115
43 150
44 200
45             </DataArray>
46           </CellData>
47         </Piece>
48       </UnstructuredGrid>
49   </VTKFile>
```

Listing 1.6: VTU example.

Morbi eu lectus arcu. Sed fringilla dui ut magna commodo, a malesuada ante pellentesque. Donec ornare facilisis pellentesque. Nulla vitae fringilla velit. Nunc id tellus nisl. Maecenas pretium elit lectus, nec consectetur nunc vulputate et. Sed facilisis magna nec gravida hendrerit. Sed a cursus nisl, in rhoncus massa. Curabitur ut nibh interdum, tempor risus vel, scelerisque nibh. Mauris quis ipsum sed risus tempor convallis ut a eros.

1.10 STL code. Used for 3D printing

Morbi eu lectus arcu. Sed fringilla dui ut magna commodo, a malesuada ante pellentesque. Donec ornare facilisis pellentesque. Nulla vitae fringilla velit. Nunc id tellus nisl. Maecenas pretium elit lectus, nec consectetur nunc vulputate et. Sed facilisis magna nec gravida hendrerit. Sed a cursus nisl, in rhoncus massa. Curabitur ut nibh interdum, tempor risus vel, scelerisque nibh. Mauris quis ipsum sed risus tempor convallis ut a eros.

```
1 solid "OpenSCAD"
2  facet normal -0.944150984287 -0.329513221979 0
3   outer loop
4     vertex -44.2175102234 -28.7303390503 17.0843906403
5     vertex -40 -25 4.99999952316
6     vertex -40 -30 4.99999952316
7   endloop
8  endfacet
9 endsolid "OpenSCAD"
```

Listing 1.7: STL example.

Morbi eu lectus arcu. Sed fringilla dui ut magna commodo, a malesuada ante pellentesque. Donec ornare facilisis pellentesque. Nulla vitae fringilla velit. Nunc id tellus nisl. Maecenas pretium elit lectus, nec consectetur nunc vulputate et. Sed facilisis magna nec gravida hendrerit. Sed a cursus nisl, in rhoncus massa. Curabitur ut nibh interdum, tempor risus vel, scelerisque nibh. Mauris quis ipsum sed risus tempor convallis ut a eros.

1.11   DOS code

Morbi eu lectus arcu. Sed fringilla dui ut magna commodo, a malesuada ante pellentesque. Donec ornare facilisis pellentesque. Nulla vitae fringilla velit. Nunc id tellus nisl. Maecenas pretium elit lectus, nec consectetur nunc vulputate et. Sed facilisis magna nec gravida hendrerit. Sed a cursus nisl, in rhoncus massa. Curabitur ut nibh interdum, tempor risus vel, scelerisque nibh. Mauris quis ipsum sed risus tempor convallis ut a eros.

```
   METAMATERIAL STL SLICER ENGINE
------------ v 0.1 ------------

--------- DEFINE PARAMS ---------
Define grid size, higher means smaller cells (int):
25

Define n of PBARL sizes, higher means smoother cells (int):
Default (15)

Output file format (BDF or SCAD or VTU or ALL):
Default (ALL)

Cell type (c or d or any combination):
cd

Define Young Modulus (int):
210000

Define boundary conditions case (0=None):
2

----------- EXECUTION -----------
Grid is: 24x24x27
Creating node cloud...
Getting mechanical properties in each node...
Generating "MSE_24x24x27_15-c.bdf" file...
Generating "MSE_24x24x27_15-d.bdf" file...
Generating "MSE_24x24x27_15-c.scad" file...
Generating "MSE_24x24x27_15-d.scad" file...
Generating "MSE_24x24x27_15-c.vtu" file...
Generating "MSE_24x24x27_15-d.vtu" file...
```

Listing 1.8: MSE runtime example

Morbi eu lectus arcu. Sed fringilla dui ut magna commodo, a malesuada ante pellentesque. Donec ornare facilisis pellentesque. Nulla vitae fringilla velit. Nunc id tellus nisl. Maecenas pretium elit lectus, nec consectetur nunc vulputate et. Sed facilisis magna nec gravida hendrerit. Sed a cursus nisl, in rhoncus massa. Curabitur ut nibh interdum, tempor risus vel, scelerisque nibh. Mauris quis ipsum sed risus tempor convallis ut a eros.

1.12 Tables

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Table 1.1: Tabla sobre XXXX.

AAA	Total	Cent.	Rod. izda	Cent.	Rod. dcha	Arcn
Long (m)	12.98	2.93	7.33	2.16	3.48	3.34
Long (m)	5.76	1.02	2.39	1.78	1.12	0.74
Tama (cm)	40.07	0.0	0.0	40.28	40.28	39.65
Super (%)	26.54	0.0	0.0	44.32	44.32	44.03
Estado global						

Proin volutpat enim ut fermentum aliquam. Nam dictum nisi eu nisl viverra fermentum. Pellentesque tristique arcu non orci congue faucibus. Fusce sit amet nisl fringilla, feugiat turpis vitae, eleifend ante. Suspendisse elementum, lectus non pulvinar bibendum, lectus massa faucibus turpis, vitae porta risus sem quis metus. Maecenas id sapien et dui lobortis imperdiet nec eu mi. Quisque porttitor tincidunt nisi, eget sagittis orci. Nunc mattis erat malesuada facilisis viverra. Maecenas sodales iaculis nisi vel tincidunt. Morbi aliquet nibh ac facilisis consectetur. In

ultrices libero quis massa porttitor cursus. Quisque suscipit ac tortor eget aliquet.

Ut eget lacus vel orci viverra maximus at at purus.

Table 1.2: Tabla 2 sobre XXXX.

Country List		
Country Name or Area Name	ISO ALPHA 2 Code	ISO ALPHA 3
Afghanistan	AF	AFG
Aland Islands	AX	ALA
Albania	AL	ALB
Algeria	DZ	DZA
American Samoa	AS	ASM
Andorra	AD	AND
Angola	AO	AGO

Cras vehicula ipsum sit amet dui rutrum ultrices. Integer eu eleifend odio.

Praesent tempor, libero id ullamcorper euismod, lectus diam lobortis mauris, id

venenatis arcu sem vitae purus. Pellentesque luctus tristique metus quis mollis.

Praesent ullamcorper neque velit, sed iaculis est convallis sit amet. Quisque nec

massa ut magna lobortis imperdiet. Quisque rhoncus purus eget mollis aliquet.

Donec vehicula viverra nisl, sed posuere turpis vulputate non. Donec malesuada,

eros id interdum volutpat, ipsum orci luctus quam, non pulvinar urna ipsum eget

purus. Nam hendrerit condimentum tristique.

1.13   Graphs and figures

Nam massa neque, varius nec suscipit id, cursus ac mi. Cum sociis natoque penatibus

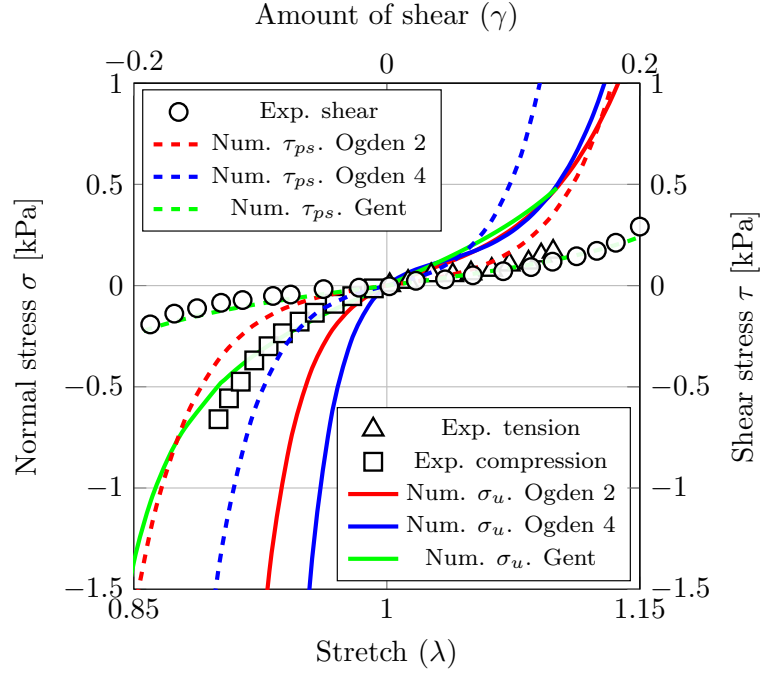et magnis dis parturient montes, nascetur ridiculus mus.

Figure 1.1: Experimental and analytical comparison.

In hac habitasse platea dictumst. Vivamus facilisis nunc quis dictum consectetur. Sed congue sed magna non auctor. Vestibulum accumsan sit amet erat non congue. Sed at condimentum mi, sed scelerisque urna. Etiam tristique pulvinar rutrum. Donec semper nulla vitae rutrum semper. Maecenas ultrices nibh at orci sodales tincidunt sit amet vitae arcu. Curabitur interdum tincidunt ipsum, nec tincidunt nunc dapibus in. Nunc sit amet elementum massa, ut ornare lacus. Vivamus convallis fringilla erat, non suscipit sapien convallis eu. Nunc viverra lectus sit amet turpis viverra, eget iaculis purus rhoncus.

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fringilla erat, non suscipit sapien convallis eu. Nunc viverra lectus sit amet turpis viverra, eget iaculis purus rhoncus.
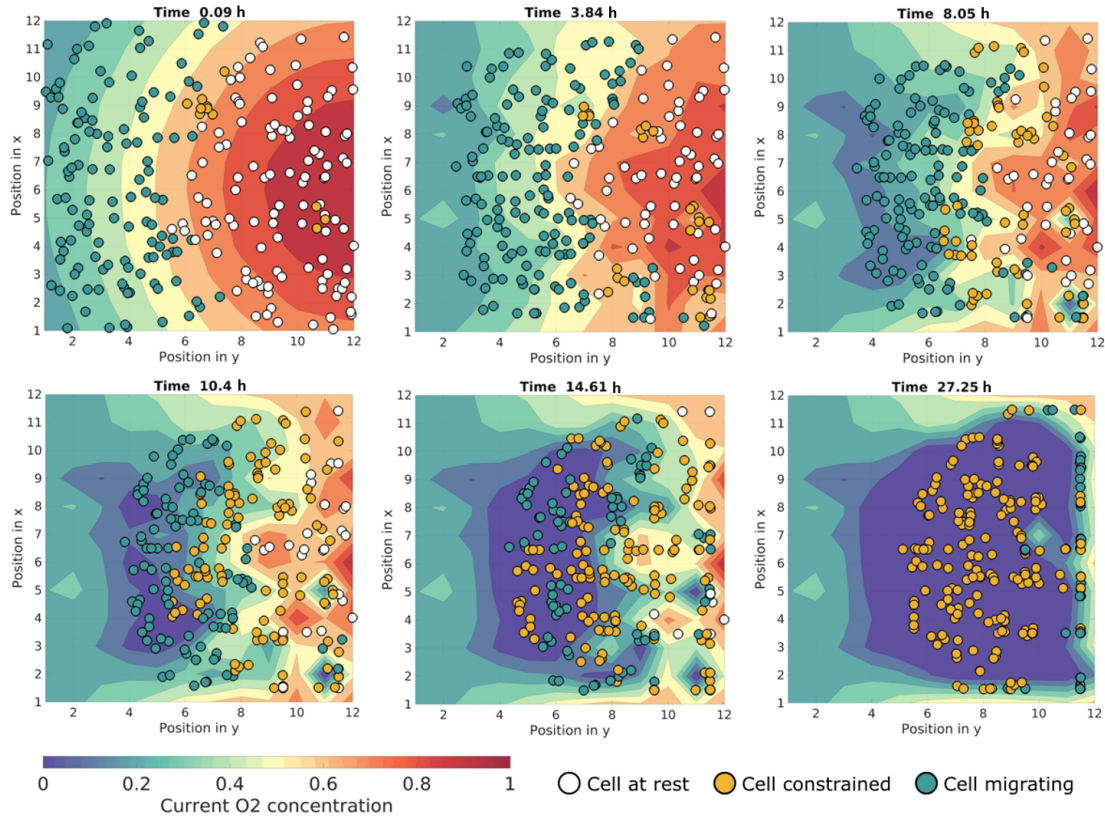

Figure 1.2: Results.

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1.14 Citations

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Cite.. [2, 1]

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Appendices

Cor animalium, fundamentum eft vitæ, princeps omnium, Microcofmi Sol, a quo omnis vegetatio dependet, vigor omnis & robur emanat.

The heart of animals is the foundation of their life, the sovereign of everything within them, the sun of their microcosm, that upon which all growth depends, from which all power proceeds.

— William Harvey

A
Review of metamaterials

Contents

Appendices are just like chapters. Their sections and subsections get numbered and included in the table of contents; figures and equations and tables added up, etc. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed et dui sem. Aliquam dictum et ante ut semper. Donec sollicitudin sed quam at aliquet. Sed maximus diam elementum justo auctor, eget volutpat elit eleifend. Curabitur hendrerit ligula in erat feugiat, at rutrum risus suscipit. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Integer risus nulla, facilisis eget lacinia a, pretium mattis metus. Vestibulum aliquam varius ligula nec consectetur. Maecenas ac ipsum odio. Cras ac elit consequat, eleifend ipsum sodales, euismod nunc. Nam vitae tempor enim, sit amet eleifend nisi. Etiam at erat vel neque consequat.

A.1 Geometry

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