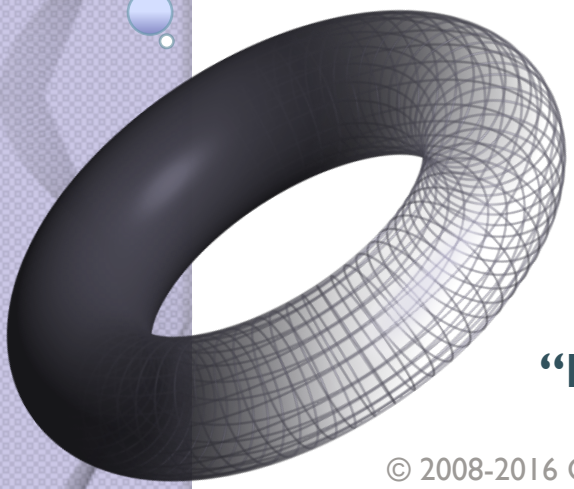
Primeiro Laboratório

Introdução ao three.js



Joe Dirksen
"Learning three.js: The JavaScript 3D Library for WebGL"

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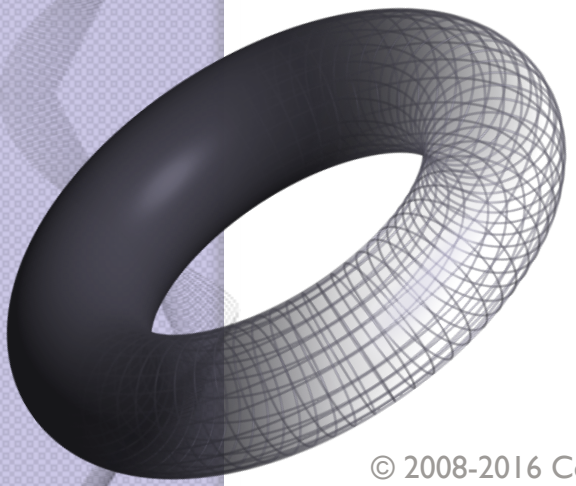
CG

Laboratório #1

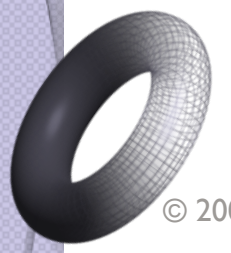
Introdução ao *three.js*

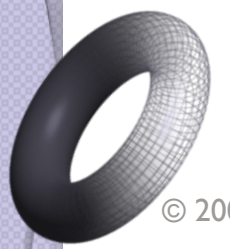


three.js

Biblioteca JavaScript

API Gráfica





Editor

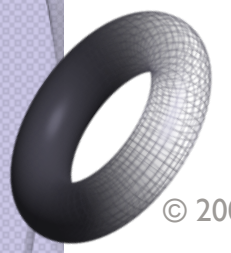
Notepad++
(apenas Windows)

Brackets
(apenas Mac)

Sublime Text Editor
(OS X, Windows, Linux)

WebStorm -- pago --
(OS X, Windows, Linux)

... ou outro da vossa preferência



Debugging

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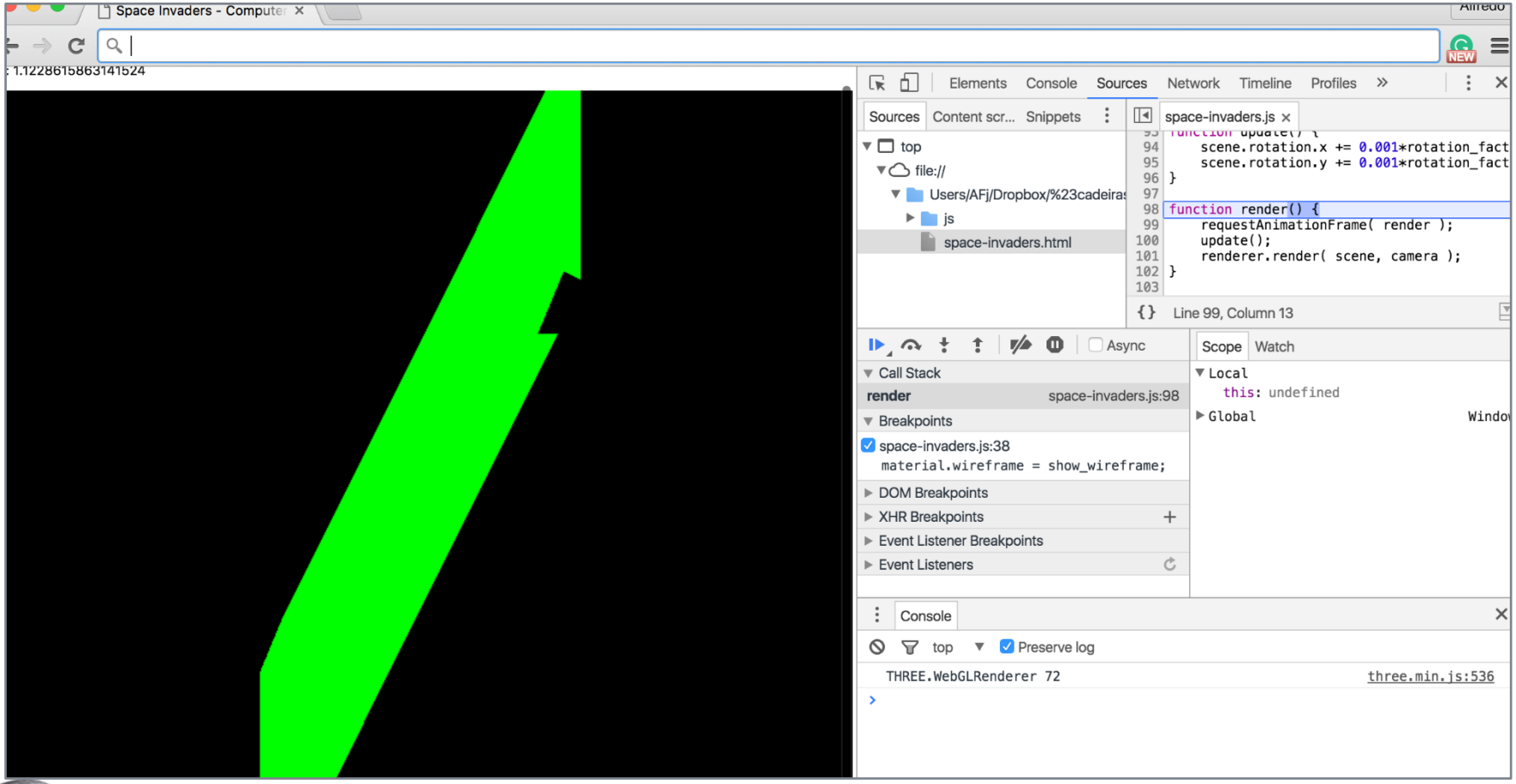
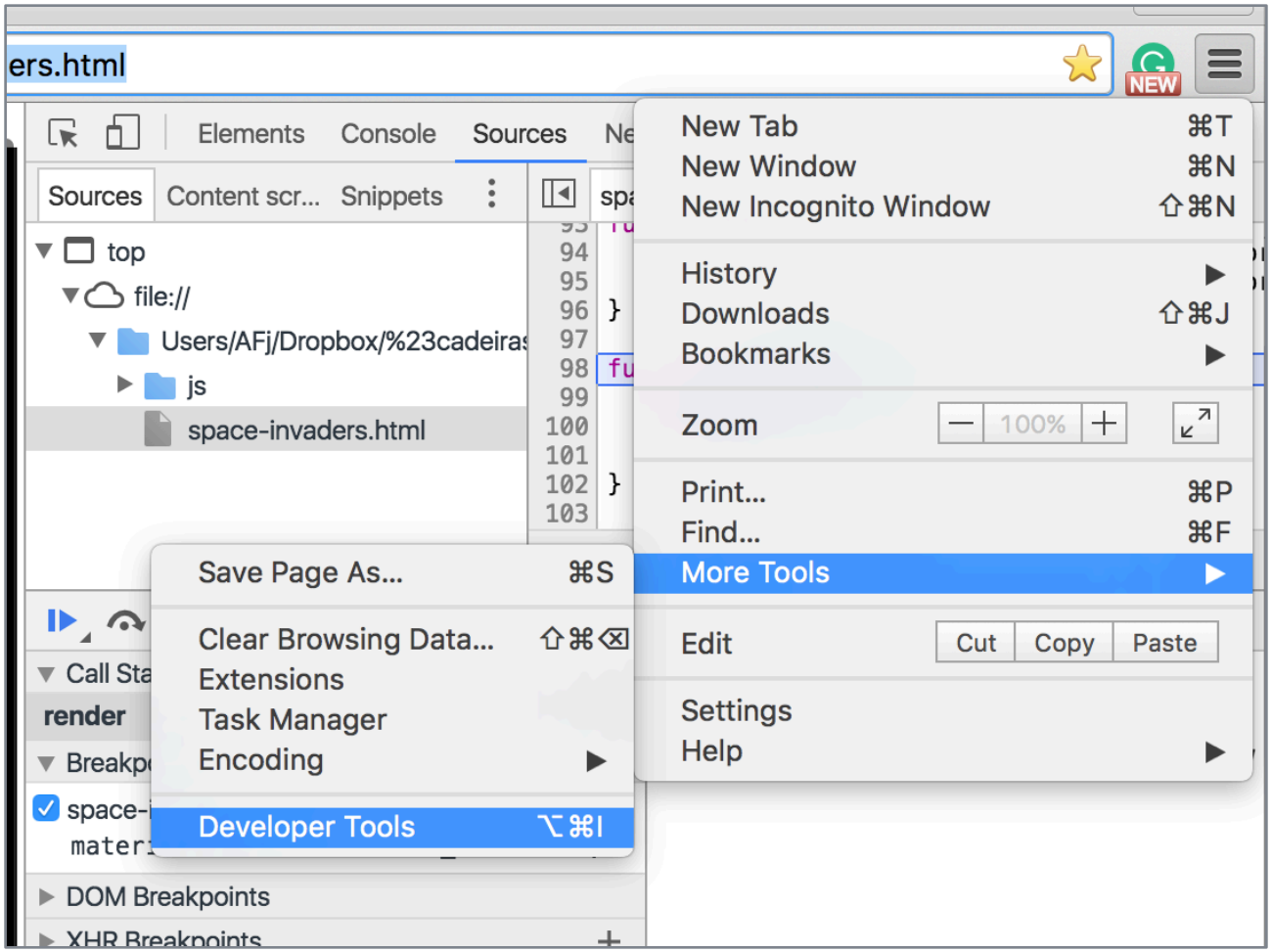


Debugging (em Chrome)



Obter o three.js

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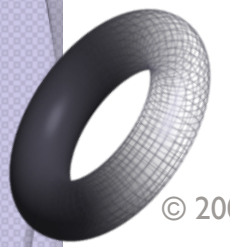
descarregar **versão completa** da página oficial

http://threejs.org/

(não recomendado, a menos que estejam a pensar trabalhar offline)



Obter o three.js

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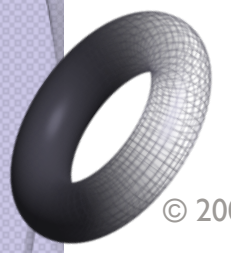
descarregar **apenas um** ficheiro Javascript

three.js ou **three.min.js**



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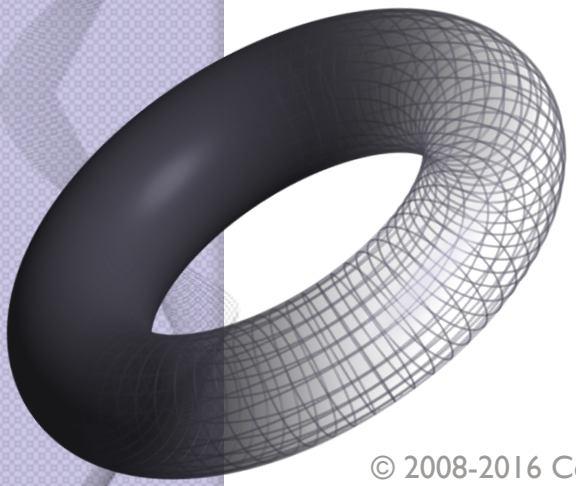
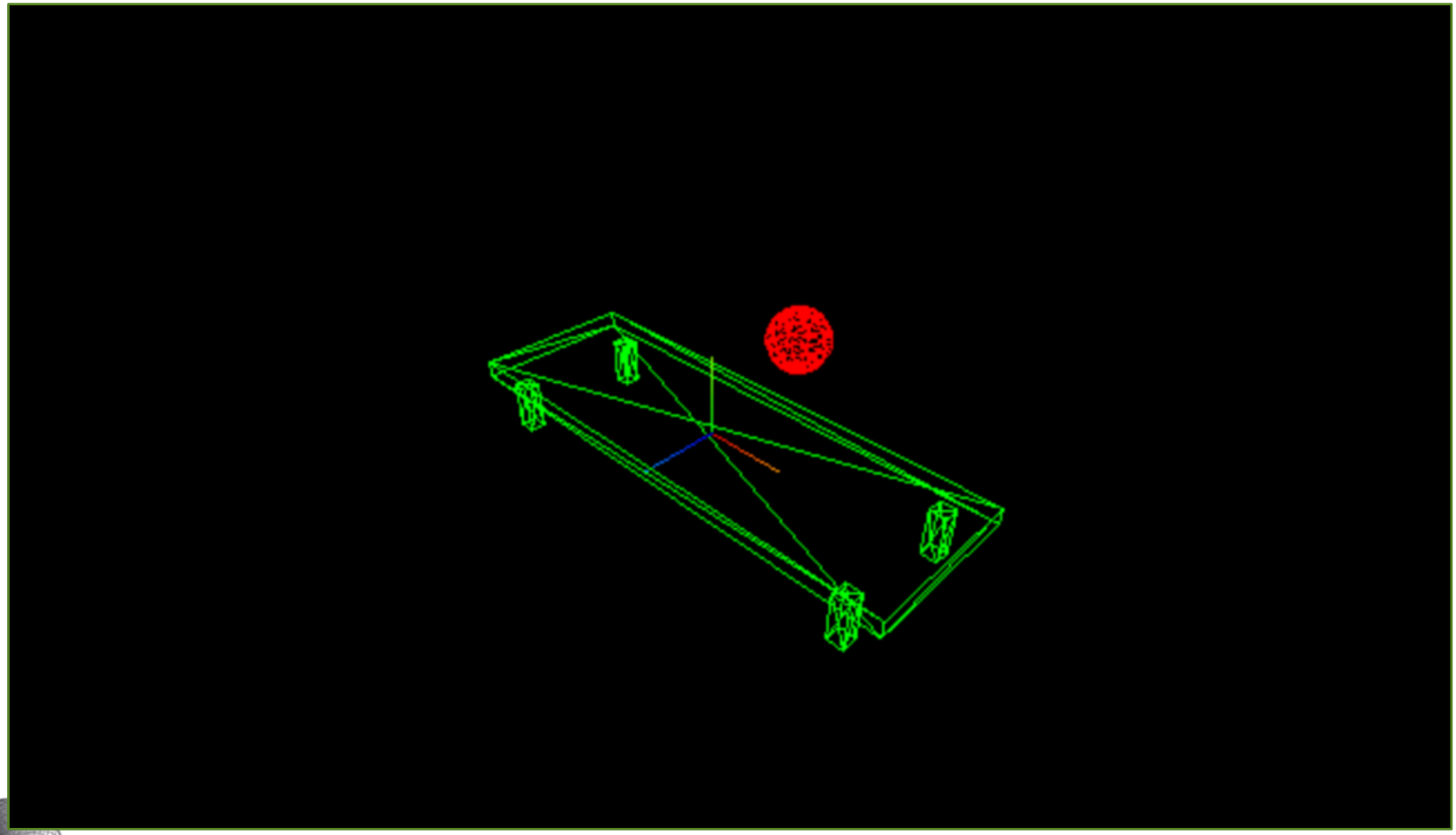
Laboratório #1

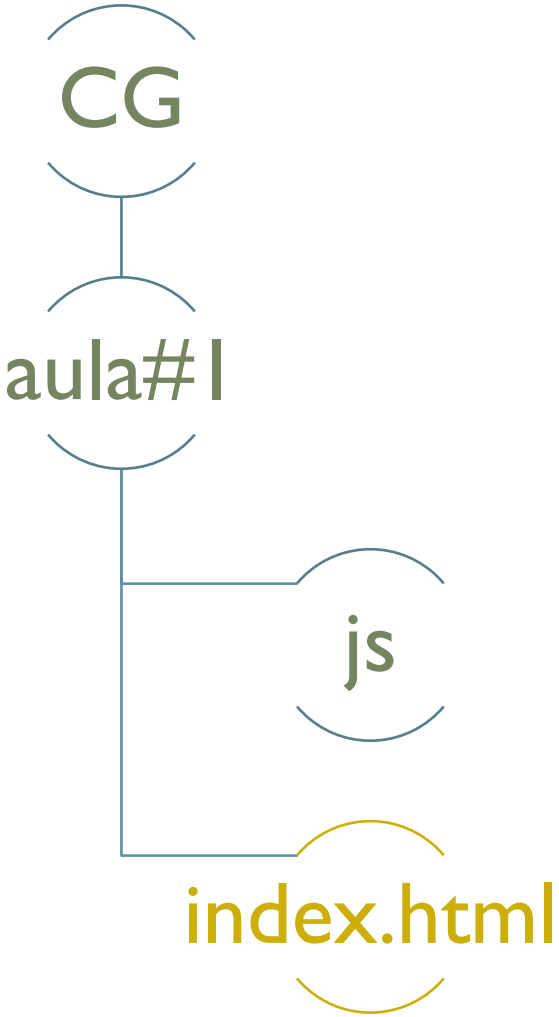
Criar a App

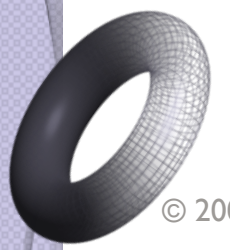


Criar a App…

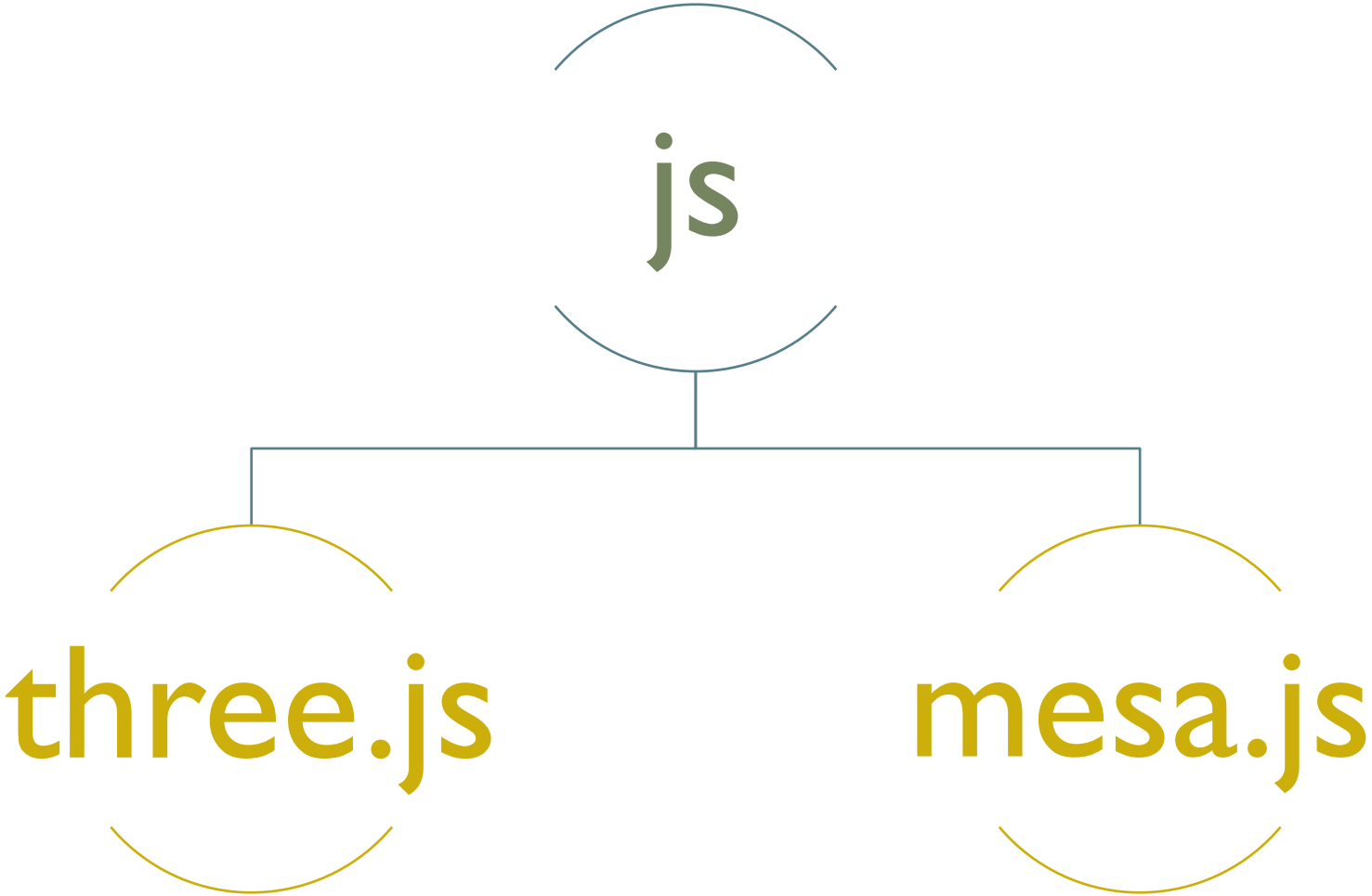


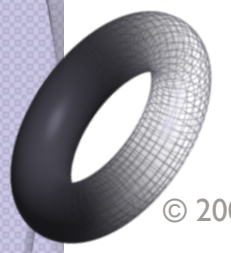
Criar pastas e ficheiros





Criar pastas e ficheiros

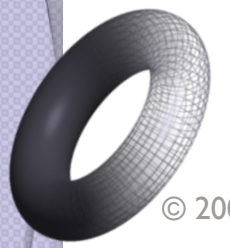




index.html

LEIC CG

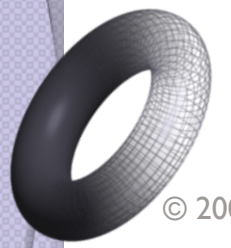
```
1   <!doctype html>
2   <html>
3       <head>
4           <meta charset="utf-8">
5           <title>1&ordf; aula - CG@IST/UL</title>
6           <style>
7               body {
8                   margin: 0px;
9                   background-color: #fff;
10                  overflow: hidden;
11          </style>
12          <script src="js/three.js"></script>
13          <script src="js/mesa.js"></script>
14      </head>
15      <body> ··· </body>
20  </html>
```



mesa.js

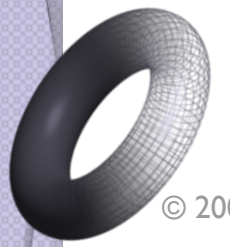
LEIC CG

```
1   /*global THREE*/
2
3   var camera, scene, renderer;
4
5 ▶ function render() { ··· }
9
10 ▶ function init() { ··· }
```



mesa.js

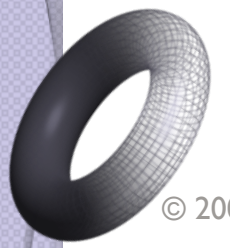

```
1   /*global THREE*/
2
3   var camera, scene, renderer;
4
5 ▶ function render() { ··· }
9
10 ▼ function init() {
11      'use strict';
12
13      renderer = new THREE.WebGLRenderer({ antialias: true });
14
15      renderer.setSize(window.innerWidth, window.innerHeight);
16
17      document.body.appendChild(renderer.domElement);
18
19      render();
20  }
```



mesa.js

LEIC CG

```
1   /*global THREE*/
2
3   var camera, scene, renderer;
4
5   function render() {
6       'use strict';
7       renderer.render(scene, camera);
8   }
9
10  function init() { ··· }
```



index.html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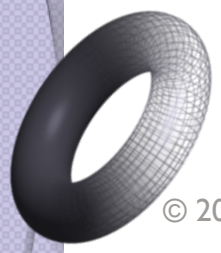
6           <style>
7               body {
8                   margin: 0px;
9                   background-color: #fff;
10                  overflow: hidden;
11          </style>
12          <script src="js/three.js"></script>
13          <script src="js/mesa.js"></script>
14      </head>
15      <body>
16          <script>
17              init();
18          </script>
19      </body>
20  </html>
```



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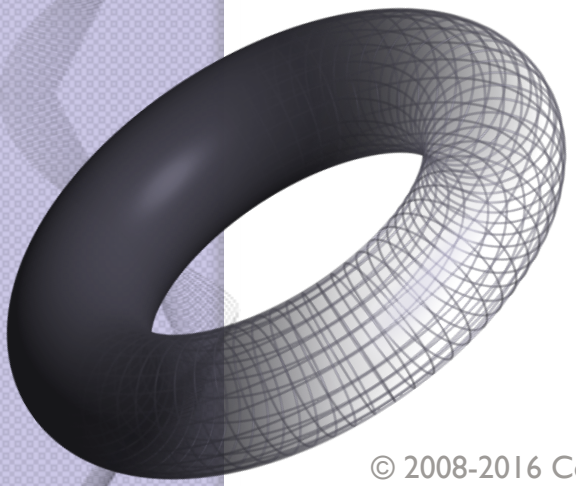
Laboratório #1

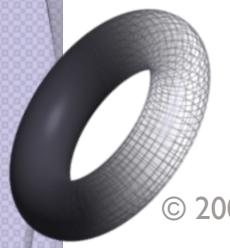
Criar a cena



mesa.js

LEIC CG

```
1   /*global THREE*/
2
3   var camera, scene, renderer;
4
5 ▶ function render() { ··· }
9
10 ▼ function createScene() {
11      'use strict';
12
13      scene = new THREE.Scene();
14
15      scene.add(new THREE.AxisHelper(10));
16
17  }
18
19 ▶ function init() { ··· }
```

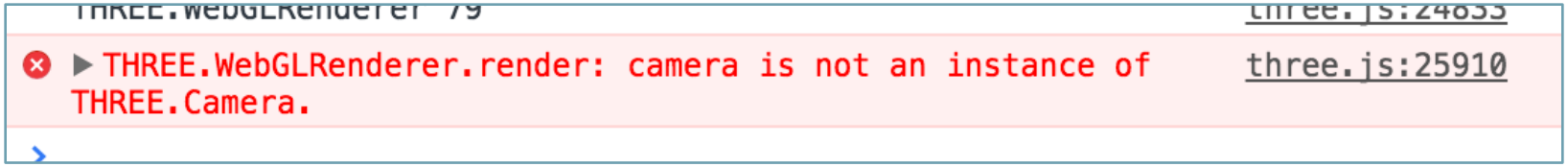


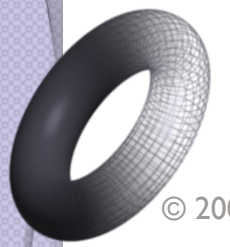
mesa.js

LEIC CG

```
 1   /*global THREE*/
 2
 3   var camera, scene, renderer;
 4
 5 ▶ function render() { ··· }
 9
10 ▶ function createScene() { ··· }
18
19 ▶ function init() {
20       'use strict';
21
22       renderer = new THREE.WebGLRenderer();
23
24       renderer.setSize(window.innerWidth, window.innerHeight);
25
26       document.body.appendChild(renderer.domElement);
27
28       createScene();
29
30       render();
31   }
```

Ao executar a App…





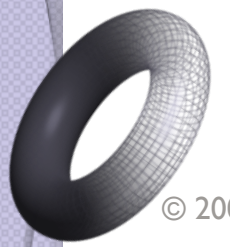
mesa.js


```
1   /*global THREE*/
2
3   var camera, scene, renderer;
4
5 ▶ function render() { ··· }
9
10 ▼ function createCamera() {
11       'use strict';
12       camera = new THREE.PerspectiveCamera(70,
13                                            window.innerWidth / window.innerHeight,
14                                            1,
15                                            1000);
16       camera.position.x = 50;
17       camera.position.y = 50;
18       camera.position.z = 50;
19       camera.lookAt(scene.position);
20   }
21
22 ▶ function createScene() { ··· }
30
31 ▶ function init() { ··· }
```

mesa.js

LEIC CG

```
1   /*global THREE*/
2
3   var camera, scene, renderer;
4
5   function render() { ··· }
9
10  function createCamera() { ··· }
21
22  function createScene() { ··· }
30
31  function init() {
32      'use strict';
33
34      renderer = new THREE.WebGLRenderer();
35
36      renderer.setSize(window.innerWidth, window.innerHeight);
37
38      document.body.appendChild(renderer.domElement);
39
40      createScene();
41      createCamera();
42
43      render();
44  }
```

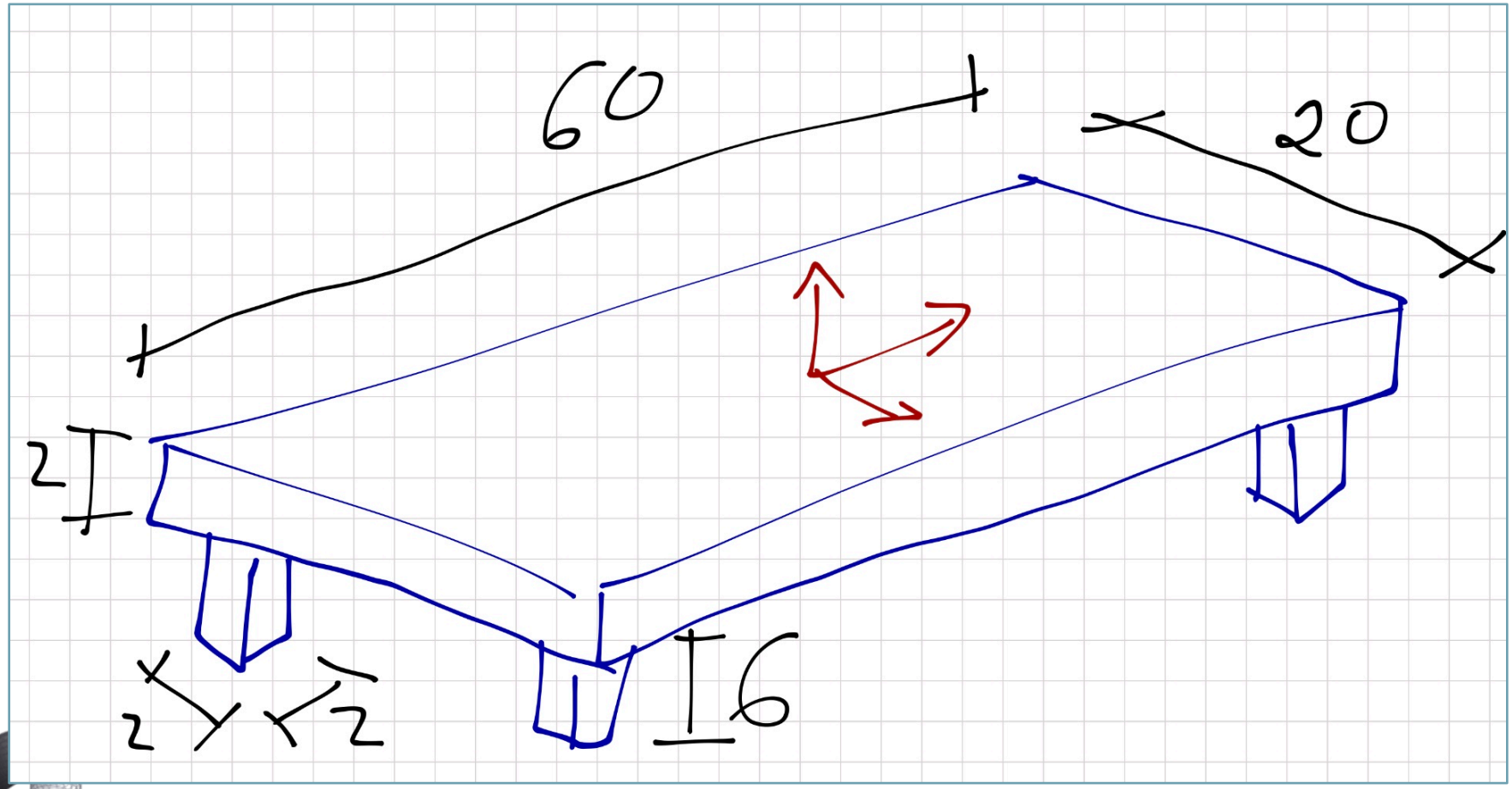


Ao executar a App…

mesa.js


```
1   /*global THREE*/
2
3   var camera, scene, renderer;
4
5   function createTable(x, y, z) {
6       'use strict';
7
8       var table = new THREE.Object3D();
9
10      material = new THREE.MeshBasicMaterial({ color: 0x00ff00, wireframe: true });
11
12      scene.add(table);
13
14      table.position.x = x;
15      table.position.y = y;
16      table.position.z = z;
17  }
18
19  function createCamera() { ··· }
30
31  function createScene() { ··· }
39
40  function render() { ··· }
44
45  function init() { ··· }
```

Geometria da Mesa



mesa.js

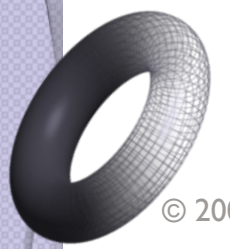
LEIC CG

```
1   /*global THREE*/
2
3   var camera, scene, renderer;
4
5   function createTable(x, y, z) {
6       'use strict';
7
8       var table = new THREE.Object3D();
9
10      material = new THREE.MeshBasicMaterial({ color: 0x00ff00, wireframe: true });
11
12      addTableTop(table, 0, 0, 0);
13      addTableLeg(table, -25, -1, -8);
14      addTableLeg(table, -25, -1, 8);
15      addTableLeg(table, 25, -1, 8);
16      addTableLeg(table, 25, -1, -8);
17
18      scene.add(table);
19
20      table.position.x = x;
21      table.position.y = y;
22      table.position.z = z;
23  }
24
25  function createCamera() { ··· }
36
37  function createScene() { ··· }
45
46  function render() { ··· }
50
51  function init() { ··· }
```

mesa.js

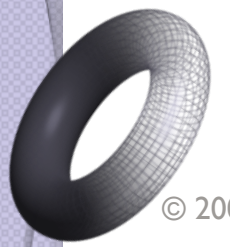
LEIC CG

```
 1   /*global THREE*/
 2
 3   var camera, scene, renderer;
 4
 5 ▼ function addTableTop(obj, x, y, z) {
 6       'use strict';
 7       geometry = new THREE.CubeGeometry(60, 2, 20);
 8       mesh = new THREE.Mesh(geometry, material);
 9       mesh.position.set(x, y, z);
10
11       obj.add(mesh);
12   }
13
14 ▶ function createTable(x, y, z) { ··· }
33
34 ▶ function createCamera() { ··· }
45
46 ▶ function createScene() { ··· }
54
55 ▶ function render() { ··· }
59
60 ▶ function init() { ··· }
```



mesa.js

```
 1   /*global THREE*/
 2
 3   var camera, scene, renderer;
 4
 5 ▼ function addTableLeg(obj, x, y, z) {
 6       'use strict';
 7
 8       geometry = new THREE.CubeGeometry(2, 6, 2);
 9       mesh = new THREE.Mesh(geometry, material);
10       mesh.position.set(x, y - 3, z);
11       obj.add(mesh);
12   }
13
14 ▶ function addTableTop(obj, x, y, z) { ··· }
22
23 ▶ function createTable(x, y, z) { ··· }
42
43 ▶ function createCamera() { ··· }
54
55 ▶ function createScene() { ··· }
63
64 ▶ function render() { ··· }
68
69 ▶ function init() { ··· }
```



mesa.js


```
/*global THREE*/

var camera, scene, renderer;

var geometry, material, mesh;

function addTableLeg(obj, x, y, z) { ··· }

function addTableTop(obj, x, y, z) { ··· }

function createTable(x, y, z) { ··· }

function createCamera() { ··· }

function createScene() {
    'use strict';

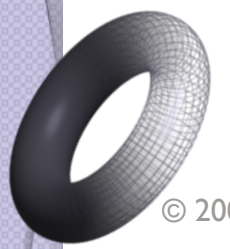
    scene = new THREE.Scene();

    scene.add(new THREE.AxisHelper(10));

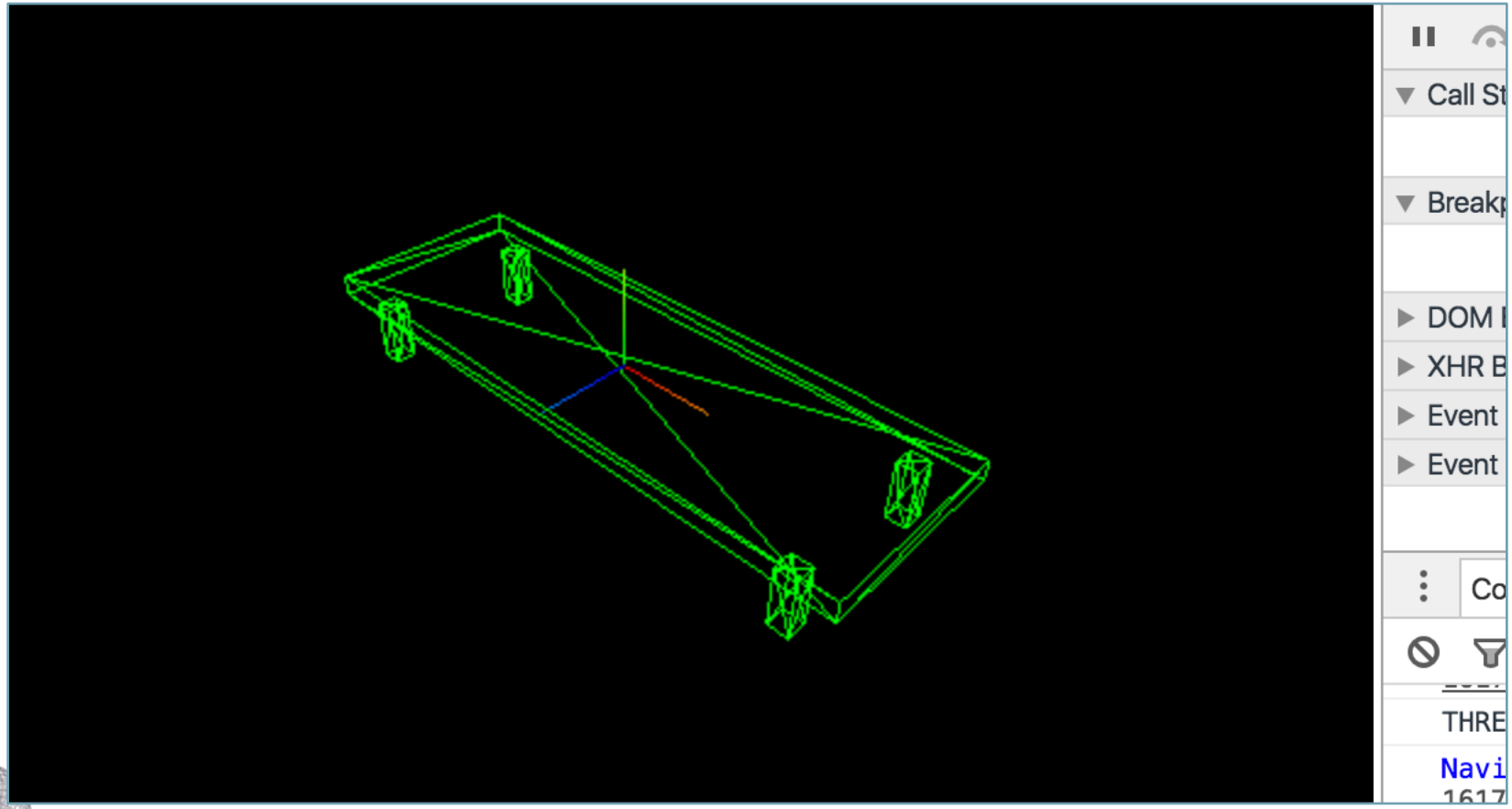
    createTable(0, 0, 0);
}

function render() { ··· }

function init() { ··· }
```



Ao executar a App…



mesa.js

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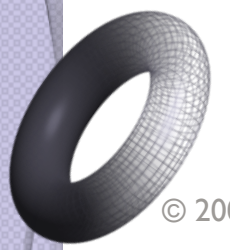
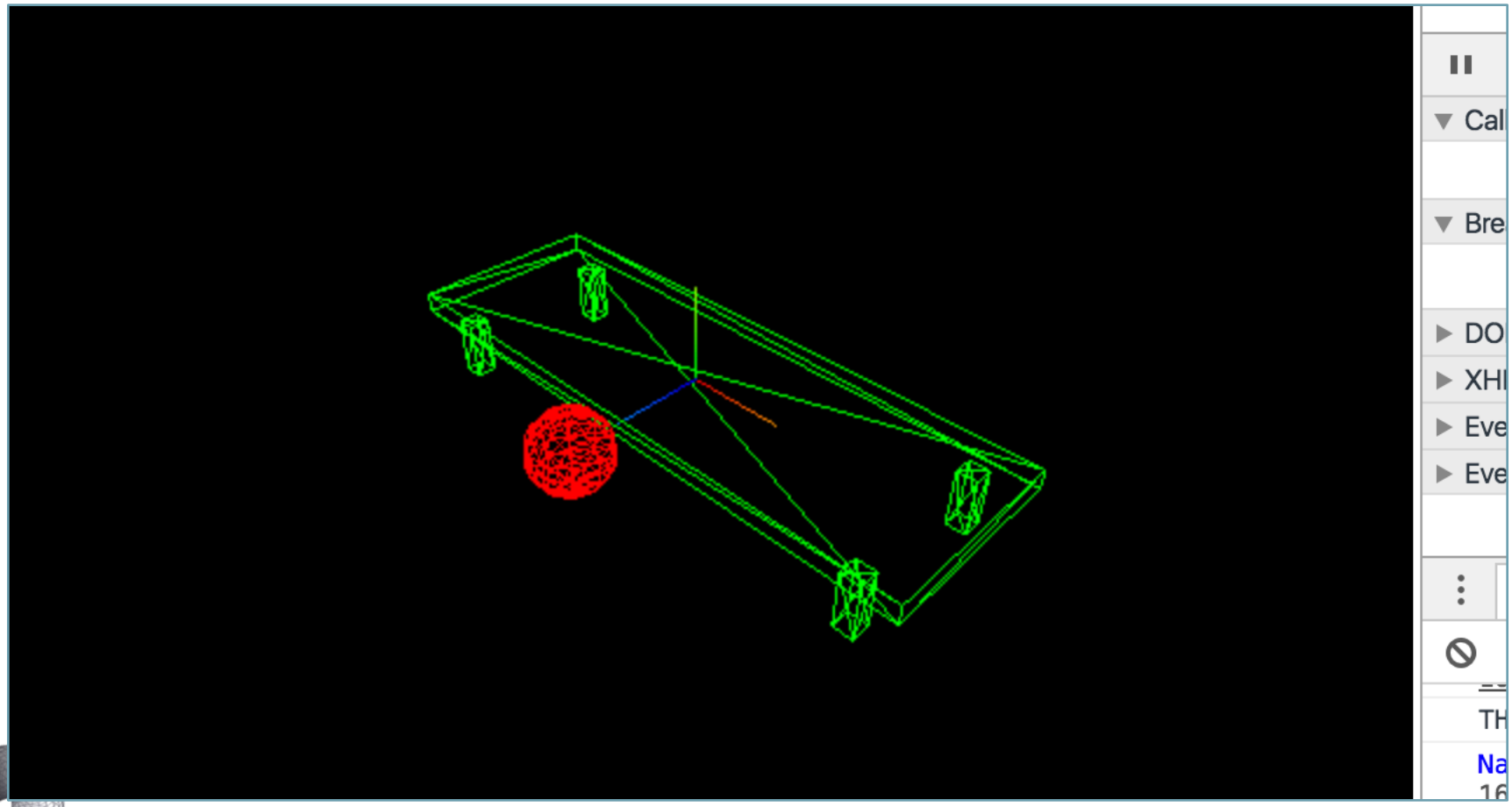
```
 5   var geometry, material, mesh;
 6
 7   var ball;
 8
 9   function createBall(x, y, z) {
10       'use strict';
11
12       ball = new THREE.Object3D();
13       ball.userData = { jumping: true, step: 0 };
14
15       material = new THREE.MeshBasicMaterial({ color: 0xff0000, wireframe: true });
16       geometry = new THREE.SphereGeometry(4, 10, 10);
17       mesh = new THREE.Mesh(geometry, material);
18
19       ball.add(mesh);
20       ball.position.set(x, y, z);
21
22       scene.add(ball);
23   }
24
25   function addTableLeg(obj, x, y, z) { ··· }
33
34   function addTableTop(obj, x, y, z) { ··· }
42
43   function createTable(x, y, z) { ··· }
```

mesa.js


```
 7   var ball;
 8
 9 ▶ function createBall(x, y, z) { ··· }
24
25 ▶ function addTableLeg(obj, x, y, z) { ··· }
33
34 ▶ function addTableTop(obj, x, y, z) { ··· }
42
43 ▶ function createTable(x, y, z) { ··· }
62
63 ▶ function createCamera() { ··· }
74
75 ▶ function createScene() {
76       'use strict';
77
78       scene = new THREE.Scene();
79
80       scene.add(new THREE.AxisHelper(10));
81
82       createTable(0, 0, 0);
83       createBall(0, 0, 15);
84   }
85
86 ▶ function render() { ··· }
```



Ao executar a App…



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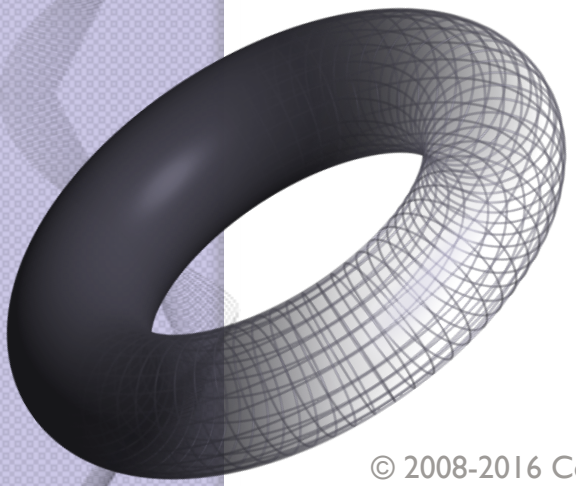
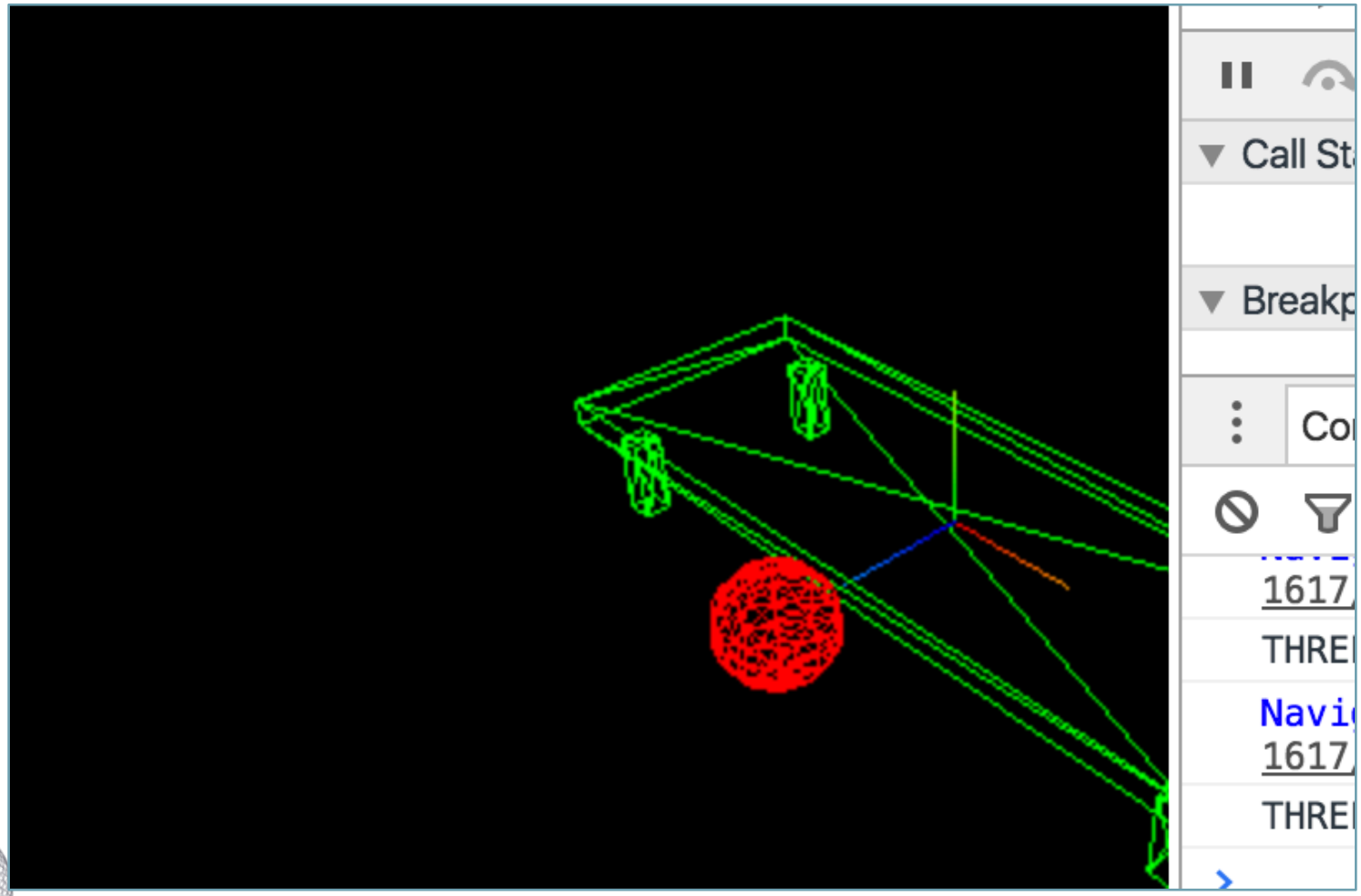
Laboratório #1

Redimensionar a janela

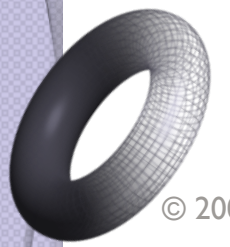


Ao redimensionar a janela…



mesa.js

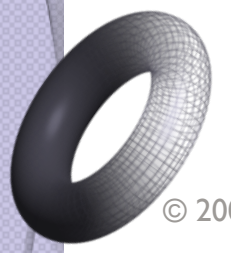
```
43 ▶ function createTable(x, y, z) { ··· }
62
63 ▶ function createCamera() { ··· }
74
75 ▶ function createScene() { ··· }
85
86 ▼ function onResize() {
87       'use strict';
88
89       renderer.setSize(window.innerWidth, window.innerHeight);
90   }
91
92 ▶ function render() { ··· }
96
97 ▶ function init() { ··· }
```



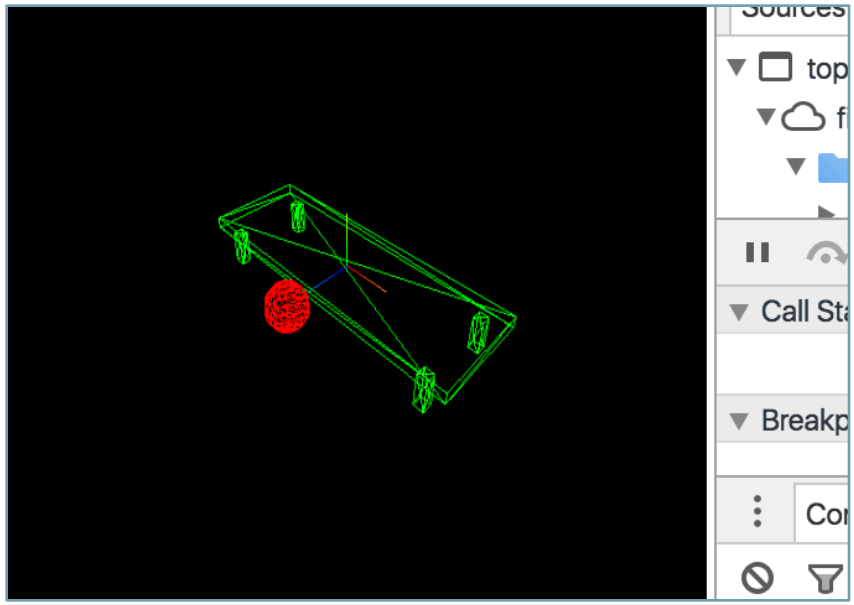
mesa.js

LEIC CG

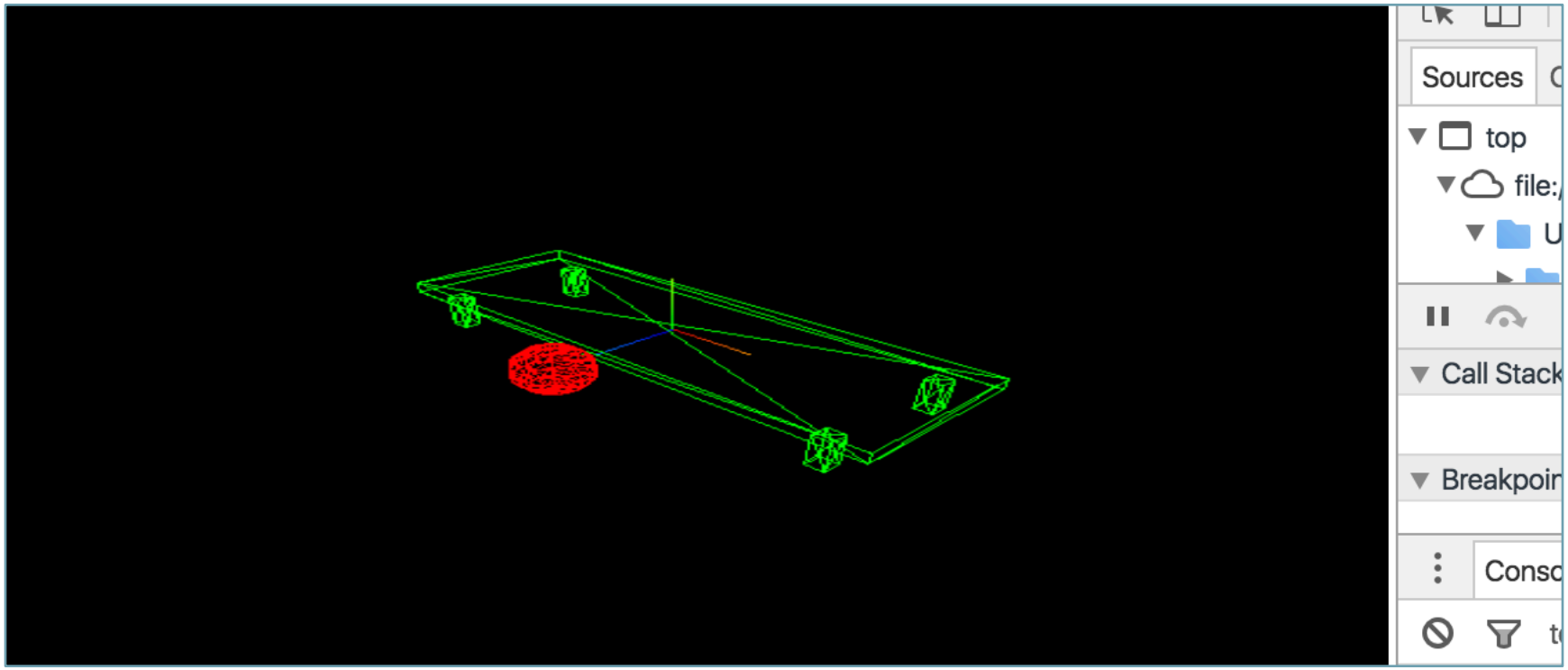
```
 75 ▶ function createScene() { ··· }
 85
 86 ▶ function onResize() { ··· }
 91
 92 ▶ function render() { ··· }
 96
 97 ▼ function init() {
 98       'use strict';
 99
100       renderer = new THREE.WebGLRenderer();
101
102       renderer.setSize(window.innerWidth, window.innerHeight);
103
104       document.body.appendChild(renderer.domElement);
105
106       createScene();
107       createCamera();
108
109       render();
110
111       window.addEventListener("resize", onResize);
112
113   }
```



Ao redimensionar a janela…



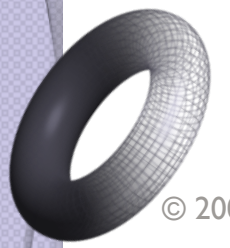
Ao redimensionar a janela…



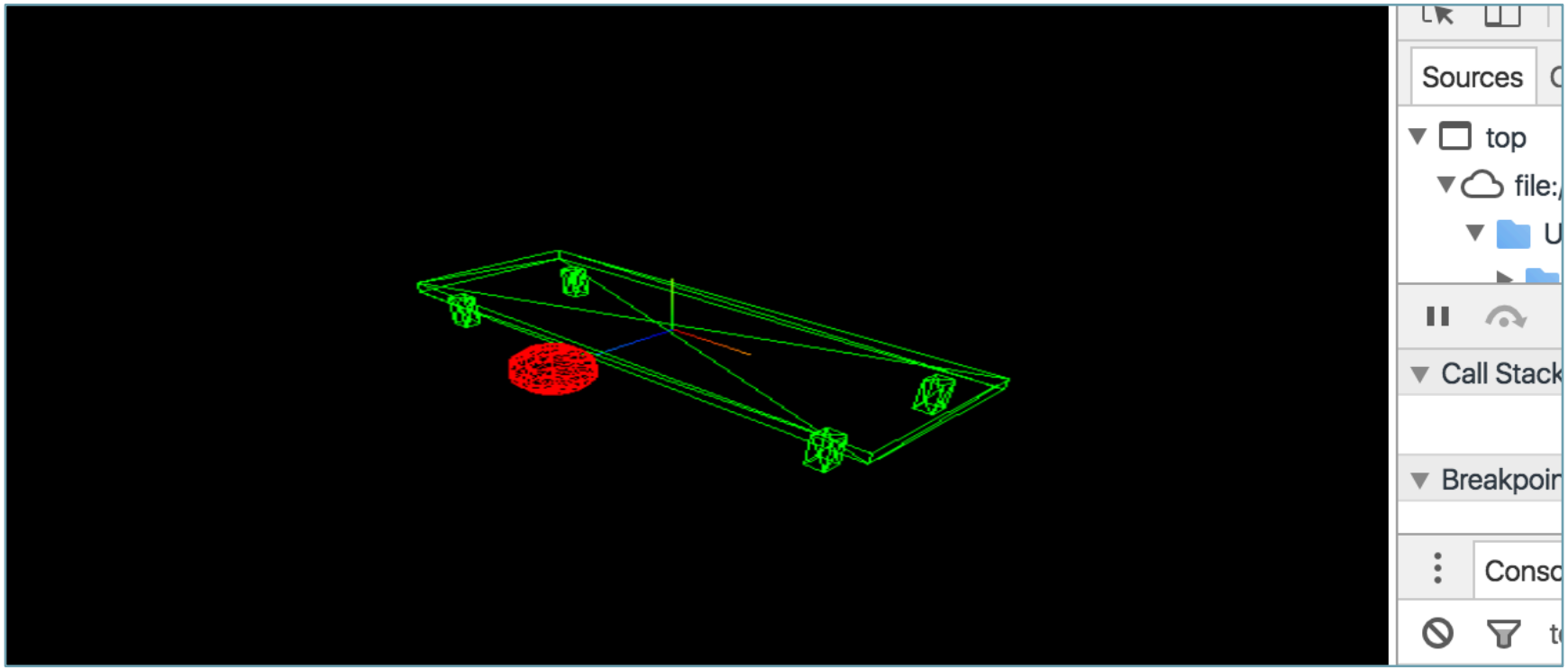
mesa.js

LEIC CG

```
 63 ▶ function createCamera() { ··· }
 74
 75 ▶ function createScene() { ··· }
 85
 86 ▶ function render() { ··· }
 90
 91 ▼ function onResize() {
 92       'use strict';
 93
 94       renderer.setSize(window.innerWidth, window.innerHeight);
 95
 96 ▼     if (window.innerHeight > 0 && window.innerWidth > 0) {
 97           camera.aspect = renderer.getSize().width / renderer.getSize().height;
 98           camera.updateProjectionMatrix();
 99       }
100   }
101
102 ▶ function init() { ··· }
```



Ao redimensionar a janela…



mesa.js

LEIC CG

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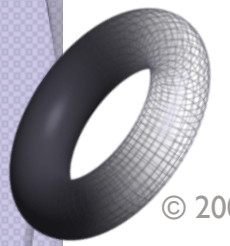
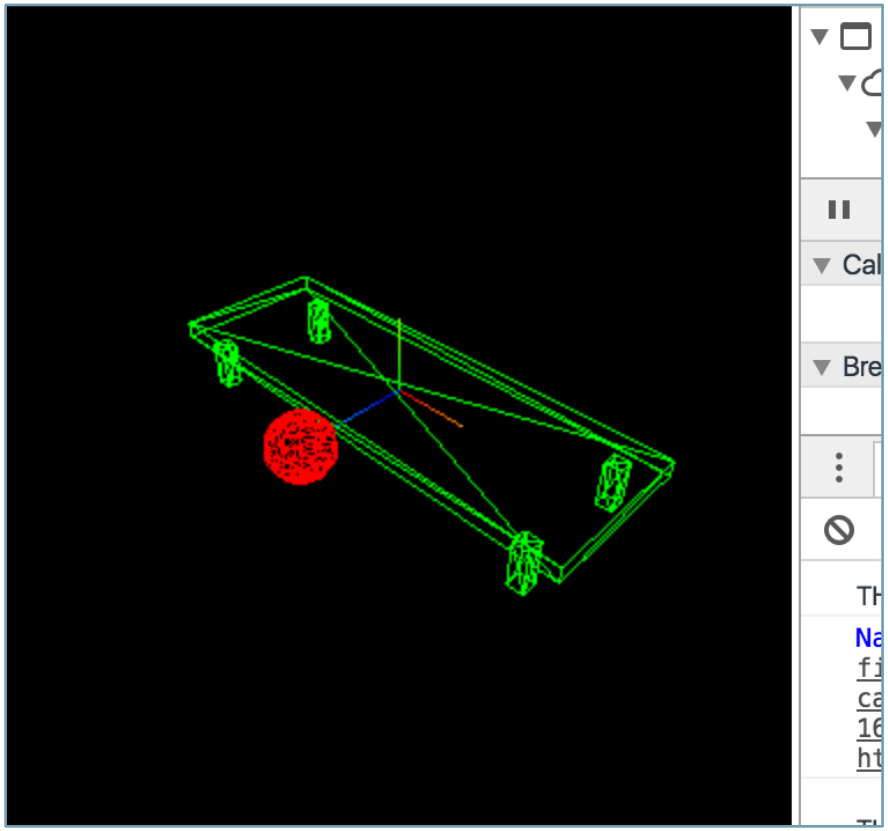
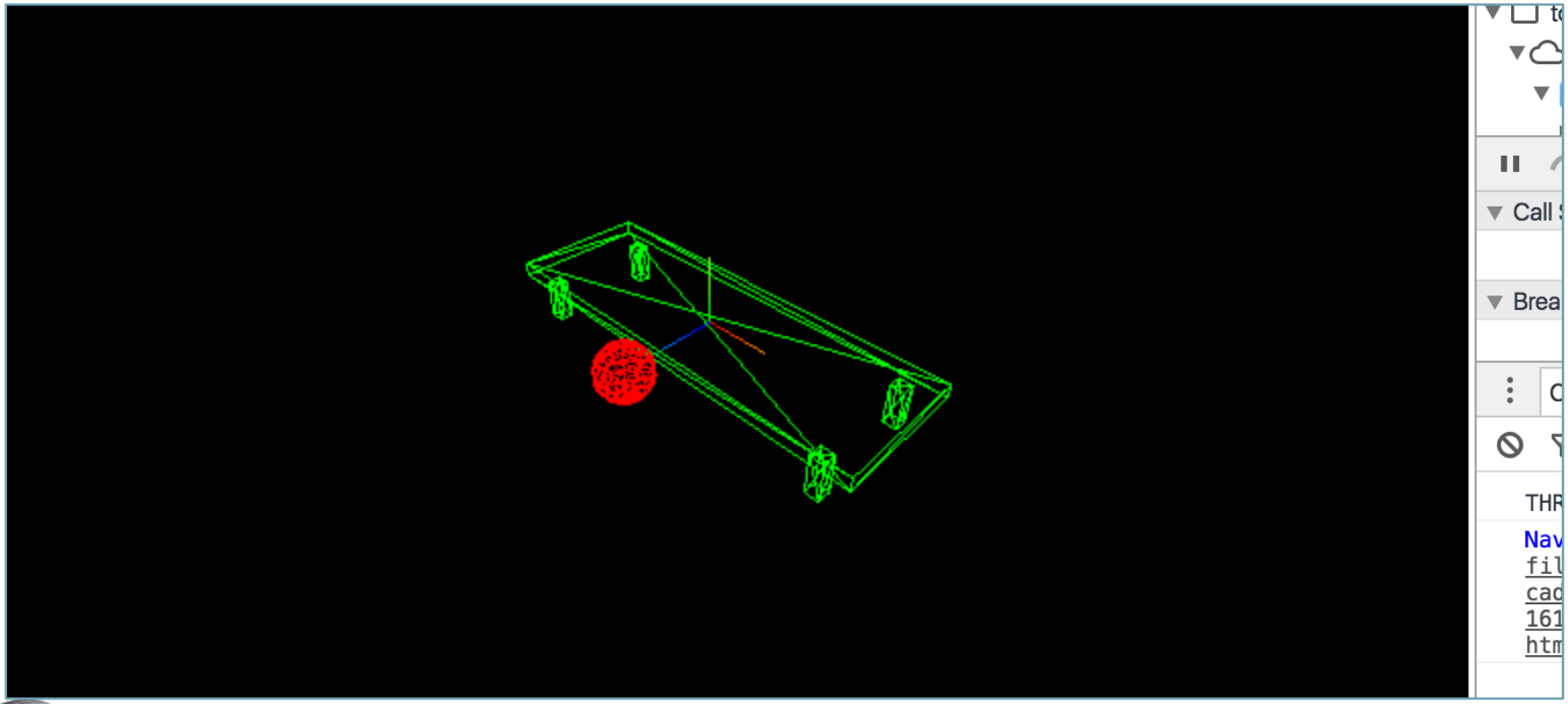


Ao redimensionar a janela…



Ao redimensionar a janela…



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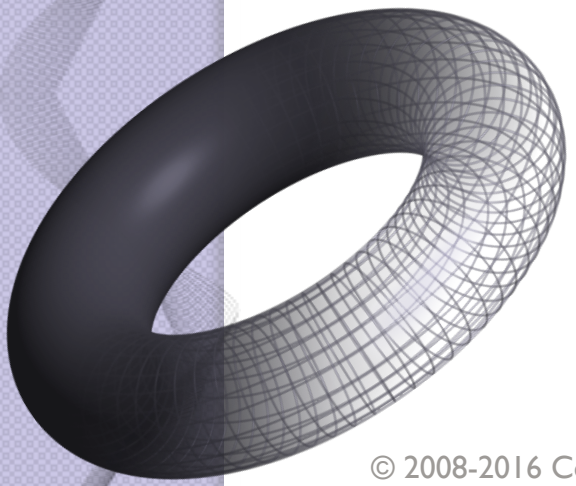
CG

Laboratório #1

Interacção



mesa.js

LEIC CG

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 75 ▶ function createScene() { ··· }
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 86 ▶ function render() { ··· }
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104 ▶ function init() {
105       'use strict';
106
107       renderer = new THREE.WebGLRenderer();
108
109       renderer.setSize(window.innerWidth, window.innerHeight);
110
111       document.body.appendChild(renderer.domElement);
112
113       createScene();
114       createCamera();
115
116       render();
117
118       window.addEventListener("resize", onResize);
119       window.addEventListener("keydown", onKeyDown);
120   }
```
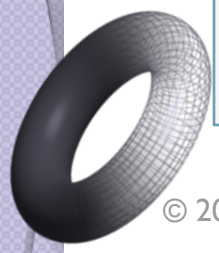
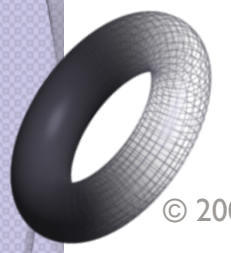



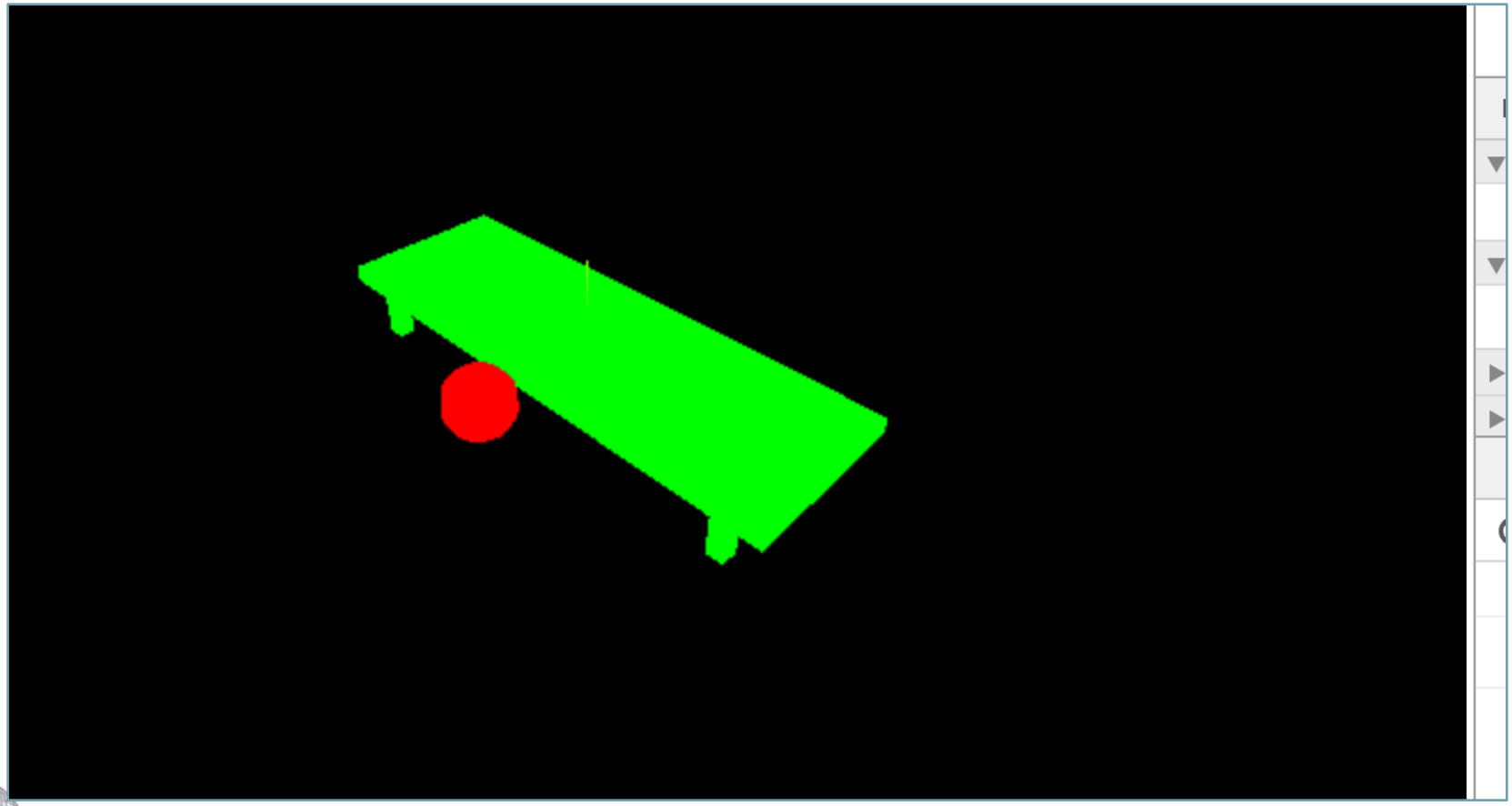
mesa.js

LEIC CG

```
 75 ▶ function createScene() { ··· }
 85
 86 ▶ function render() { ··· }
 90
 91 ▶ function onResize() { ··· }
103
104 ▼ function onKeyDown(e) {
105       'use strict';
106
107 ▼     switch (e.keyCode) {
108       case 65: //A
109       case 97: //a
110 ▼         scene.traverse(function (node) {
111 ▼             if (node instanceof THREE.Mesh) {
112                   node.material.wireframe = !node.material.wireframe;
113               }
114           });
115           break;
116       }
117
118       render();
119   }
120
121 ▶ function init() { ··· }
```



Ao executar a App…



mesa.js

LEIC CG

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 91 ▶ function onResize() { ··· }
103
104 ▼ function onKeyDown(e) {
105       'use strict';
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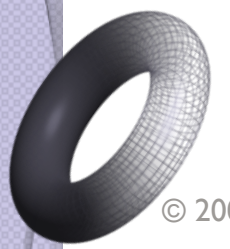
107 ▼     switch (e.keyCode) {
108       case 65: //A
109       case 97: //a
110 ▼         scene.traverse(function (node) {
111 ▼             if (node instanceof THREE.Mesh) {
112                   node.material.wireframe = !node.material.wireframe;
113               }
114           });
115           break;
116       case 83:  //S
117       case 115: //s
118           ball.userData.jumping = !ball.userData.jumping;
119           break;
120       }
121
122       render();
123   }
124
125 ▶ function init() { ··· }
```



mesa.js

LEIC CG

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104 ▼ function onKeyDown(e) {
105       'use strict';
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111 ▼             if (node instanceof THREE.Mesh) {
112                   node.material.wireframe = !node.material.wireframe;
113               }
114           });
115           break;
116       case 83:  //S
117       case 115: //s
118           ball.userData.jumping = !ball.userData.jumping;
119           break;
120       }
121
122       render();
123   }
124
125 ▶ function init() { ··· }
```
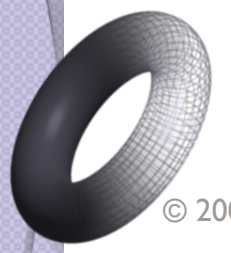

```
 7   var ball;
 8
 9 ▼ function createBall(x, y, z) {
10       'use strict';
11
12       ball = new THREE.Object3D();
13       ball.userData = { jumping: true, step: 0 };
14
15       material = new THREE.MeshBasicMaterial({ col
```



mesa.js

LEIC CG

```
 91 ▶ function onResize() { ··· }
103
104 ▼ function onKeyDown(e) {
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114           });
115           break;
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118           ball.userData.jumping = !ball.userData.jumping;
119           break;
120       }
121
122       render();
123   }
124
125 ▶ function init() { ··· }
```

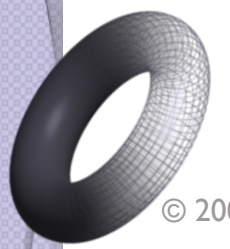

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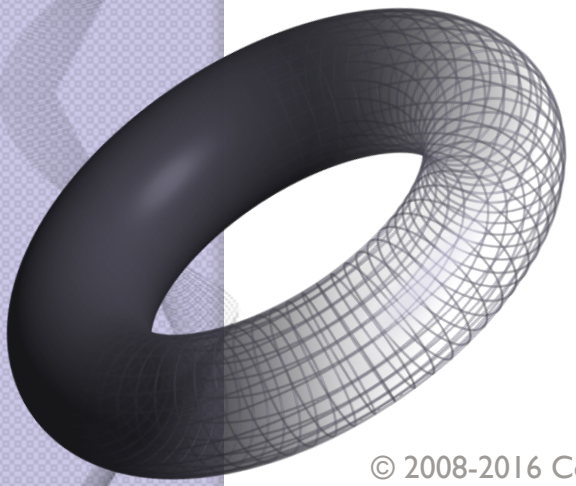
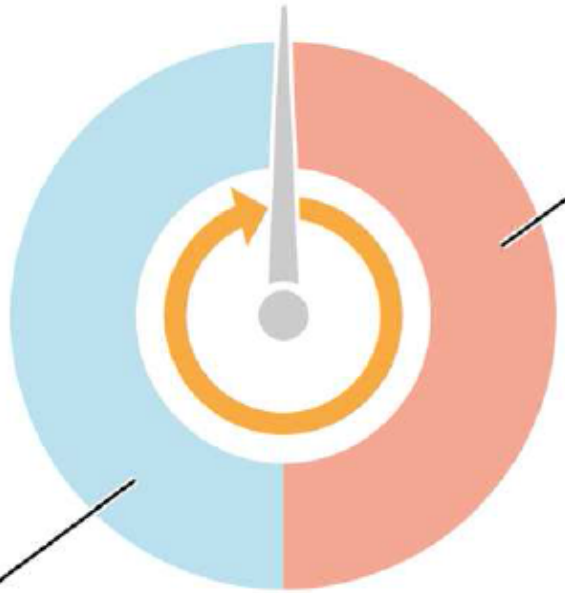
CG

Laboratório #1

Animação



Ciclo Update/Display

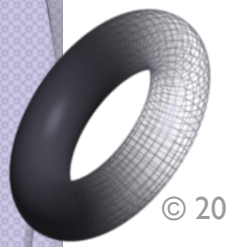


Update

```
For each object
  object.update
        (pos=pos+vel*dt)
        ...
```

Display

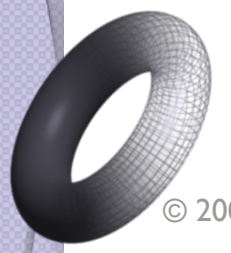
```
Clear Display
Set projection matrix
Set visualization matrix
For each object
  object.draw
Flush
```



mesa.js

LEIC CG

```
104 ▶ function onKeyDown(e) { ··· }
124
125 ▼ function animate() {
126       'use strict';
127
128 ▼     if (ball.userData.jumping) {
129           ball.userData.step += 0.04;
130           ball.position.y = Math.abs(30 * (Math.sin(ball.userData.step)));
131           ball.position.z = 15 * (Math.cos(ball.userData.step));
132       }
133       render();
134
135       requestAnimationFrame(animate);
136   }
137
138 ▶ function init() { ··· }
```



mesa.html

LEIC CG

```
1   <!doctype html>
2   <html>
3       <head>
4           <meta charset="utf-8">
5           <title>1&ordf; aula - CG@IST/UL</title>
6           <style>
7               body {
8                   margin: 0px;
9                   background-color: #fff;
10                  overflow: hidden;
11          </style>
12          <script src="js/three.js"></script>
13          <script src="js/mesa.js"></script>
14      </head>
15      <body>
16          <script>
17              init();
18              animate()
19          </script>
20      </body>
21  </html>
```

mesa.js

LEIC CG

```
90
91  function onResize() {
92      'use strict';
93
94      renderer.setSize(window.innerWidth, window.innerHeight);
95
96      if (window.innerHeight > 0 && window.innerWidth > 0) {
97          camera.aspect = renderer.getSize().width / renderer.getSize().height;
98          camera.updateProjectionMatrix();
99      }
100
101     render();
102 }
103
104 function onKeyDown(e) {
105     'use strict';
106
107     switch (e.keyCode) {
108     case 65: //A
109     case 97: //a
110         scene.traverse(function (node) {
111             if (node instanceof THREE.Mesh) {
112                 node.material.wireframe = !node.material.wireframe;
113             }
114         });
115         break;
116     case 83:  //S
117     case 115: //s
118         ball.userData.jumping = !ball.userData.jumping;
119         break;
120     }
121
122     render();
123 }
124
125 function animate() { ··· }
```

mesa.js

LEIC CG

```
 91 function onResize() {
 92     'use strict';
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115     case 115: //s
116         ball.userData.jumping = !ball.userData.jumping;
117         break;
118     }
119 }
120
121 function animate() { ··· }
```
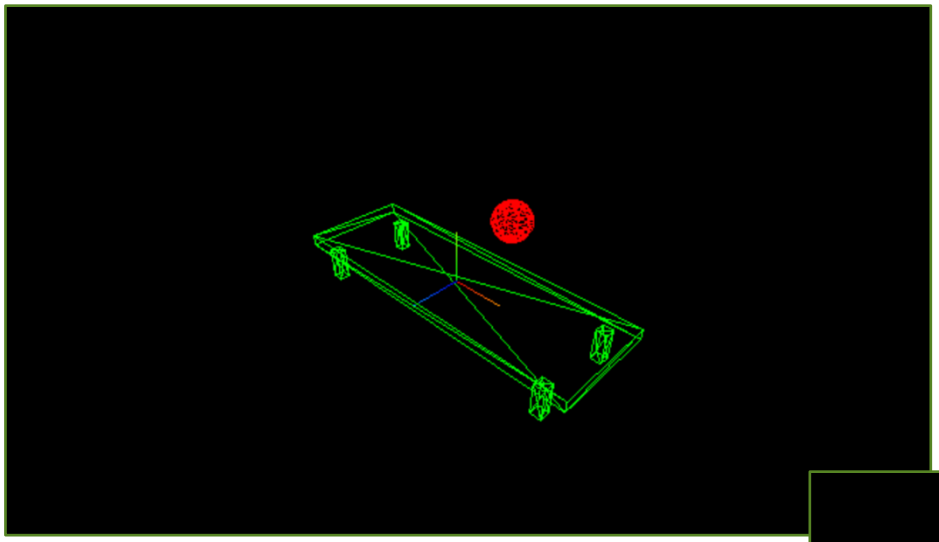
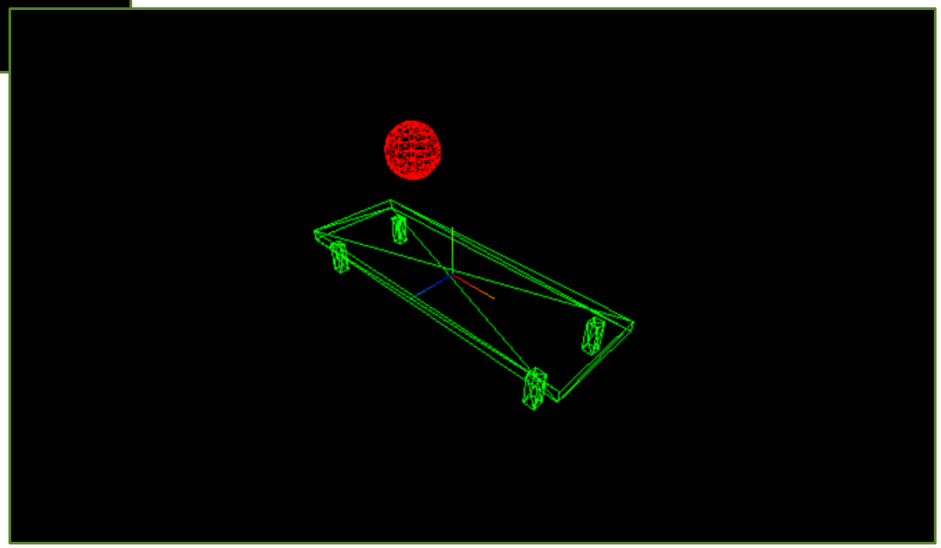

Ao executar a App…





E agora…