

Computer Graphics: Geometry and Simulation

Coursework 3: Debugging Geometry and Simulation

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Introduction

Throughout this report are a series of code snippets, highlighting the changes made to the original code to fix the bugs. The **pink** sections have been removed from the original code, while the **green** sections have been added.

1 As-Rigid-as-Possible Deformation

1.1

```
1 g.row(j) = (origV.row(E(j, 0 1)) - origV.row(E(j, 1 0))) * REdge;
```

Listing 1: The `0` and `1` have been swapped.

1.2

```
1 MatrixXd rhs = d0I.transpose() * W * (g - d0B * constPositions);
```

Listing 2: The `* W` was missing.

1.3

```
1 for (int k = 0; k < oneRings[j].size(); k++) {
2     P.row(k) = origV.row(oneRings[j][k]) - origV.row(j);
3     P.row(k) = origV.row(oneRings[j][k]) - origV.row(j);
4     Q.row(k) = currV.row(oneRings[j][k]) - currV.row(j);
5     Q.row(k) = currV.row(oneRings[j][k]) - currV.row(j);
6 }
7 S = Q.P.transpose() * P.Q;
8 Eigen::JacobiSVD<Eigen::Matrix3d> svd(S, Eigen::ComputeFullU
  | Eigen::ComputeFullV);
9 Eigen::Matrix3d U = svd.matrixU();
10 Eigen::Vector3d Sigma = svd.singularValues();
11 Eigen::Matrix3d Vt = svd.matrixV().transpose();
12 Matrix3d currR = U * Vt;
13 if (currR.determinant() < 0.0) {
14     // check where the smallest singular values falls
```

```

15 int minValue, minIndex;
16 minValue = Sigma.minCoeff(&minIndex);
17 Matrix3d newSigma = Matrix3d::Identity();
18 newSigma(minIndex, minIndex) = -1;
19 currR = U * newSigma * Vt;
20 }
21 R[j] = currR;
22 }

```

Listing 3: Lines 3 and 5 have been removed. The `for` loop is now closed on line 6 instead of 22. `P` and `Q` on line 7 have been swapped. Lines 7 to 21 are no longer indented.

2 Multi-body Rigid Simulation

2.1

Pairwise gravity was reversed. Two possible fixes:

```

1 forces.row(i).array() = forces.row(i) - + forceDirection *
  gravityConstant / sqrDistance;
2 forces.row(j).array() = forces.row(j) + - forceDirection *
  gravityConstant / sqrDistance;

```

Listing 4: The `+` and `-` have been swapped.

```

1 RowVector3d forceDirection = spherePoses.row(j,i) - spherePoses.
  row(i,j);

```

Listing 5: The `i` and `j` have been swapped.

2.2

```

1 if (sqrDistance < 2 4 * sqrRadius)

```

Listing 6: The `2` has been replaced with `4`.

2.3

```

1 if (sphereVelocities(i, 1) > < 0.0)

```

Listing 7: The `>` has been swapped with `<`.