

C++ code 2.14.26: Sub-problem (2-14.w): Implementation of `computeCRL2Error`, → [GitLab](#)

```
2  template <typename FUNCTION>
3  double computeCRL2Error(std::shared_ptr<CRFeSpace> fe_space ,
4                          const Eigen::VectorXd &mu, FUNCTION &&u) {
5      double l2_error = 0.;
6
7      // TODO: task 2-14.w
8      // Obtain local-to-global map and current mesh object
9      const If::assemble::DofHandler &dof_handler{fe_space->LocGlobMap()};
10     auto mesh_ptr = fe_space->Mesh();
11
12     // Loop over all cells of the mesh (entities of co-dimension 0)
13     for (const If::mesh::Entity *cell : mesh_ptr->Entities(0)) {
14         const If::assemble::size_type num_nodes = cell->RefEl().NumNodes();
15         LF_ASSERT_MSG(num_nodes == 3, "Only meaningful for triangles!");
16         // Obtain pointer to shape information for cell
17         const If::geometry::Geometry *cell_geom{cell->Geometry()};
18         // 2x3- matrix with corner coordinates in its columns
19         const Eigen::MatrixXd vertices{If::geometry::Corners(*cell_geom)};
20         // clang-format off
21         // 2x3-matrix of midpoint coordinates
22         Eigen::MatrixXd midpoints{vertices *
23             (Eigen::Matrix<double, 3, 3>(3,3) <<
24                 0.5, 0.0, 0.5,
25                 0.5, 0.5, 0.0,
26                 0.0, 0.5, 0.5)
27             .finished()};
28         // clang-format on
29         // Obtain global indices of local shape functions
30         std::span<const If::assemble::gdof_idx_t> cell_dof_idx(
31             dof_handler.GlobalDofIndices(*cell));
32
33         // Sum contributions of quadrature nodes
34         double local_sum = 0.;
35         // The CR interpolation nodes are the midpoints and so the exact
36         // solution needs to be evaluated at the same points
37         for (int loc_idx = 0; loc_idx < num_nodes; ++loc_idx) {
38             local_sum +=
39                 std::pow(mu[cell_dof_idx[loc_idx]] - u(midpoints.col(loc_idx)), 2);
40         }
41         // Sum cell contributions
42         l2_error += If::geometry::Volume(*cell_geom) * (local_sum / num_nodes);
43     }
44     return std::sqrt(l2_error);
45 }
```