1.We have developed the initial version of our in-house code based on deal.ii tutorial step-46. This code is capable of addressing fluid-structure interaction (FSI) problems within the hp-nothing formulation framework.

First, familiarize yourself with the fundamental concepts of deal.ii.

https://www.dealii.org/current/doxygen/deal.II/index.html
http://dealii.org/current/doxygen/deal.II/Tutorial.html

Then, familiarize yourself with the member functions used in step-46
https://www.dealii.org/current/doxygen/deal.II/step_1.html
https://www.dealii.org/current/doxygen/deal.II/step_2.html
https://www.dealii.org/current/doxygen/deal.II/step_3.html
https://www.dealii.org/current/doxygen/deal.II/step_4.html
https://www.dealii.org/current/doxygen/deal.II/step_6.html
https://www.dealii.org/current/doxygen/deal.II/step_8.html
https://www.dealii.org/current/doxygen/deal.II/step_22.html
https://www.dealii.org/current/doxygen/deal.II/step_27.html
https://www.dealii.org/current/doxygen/deal.II/step_46.html

2. If you decide to use the external mesh file generated by GMSH (complex geometry case), you may need to refer to

https://www.dealii.org/current/doxygen/deal.II/classGridIn.html
https://www.dealii.org/current/doxygen/deal.II/step_49.html
https://gmsh.info/doc/texinfo/gmsh.html

3.If you've understood all the material mentioned above, you should be able to follow the in-house code. I assumed that you have read our JCP paper: https://www.sciencedirect.com/science/article/abs/pii/S0021999121007464?via%3Dihub

In our code, we have numerous template functions that can be roughly divided into three complexity levels based on either their conceptual difficulty or their code complexity.

Level 1:

Identify fluid and solid regions.

This includes template functions such as cell_is_in_fluid_domain() and cell_is_in_hydrogel_domain()

Create mesh and finite element discretizations in each corresponding region.

It involves template functions such as, make_grid(), create_fe_multiplicities(), and set_active_fe_indices()

Distribute degrees of freedom.

Template function: setup_dofs().

Set up boundary conditions.

Template function: make_boundary_constraints_hp.

Output the results. output_results()

Level 2:

Assemble and solve the system

Template function:

local_assemble_volume()
copy_local_to_global_volume()
assemble_volume_system_workstream()
solve_volume()

local_assemble_hp()
copy_local_to_global_hp()
assemble_system_workstream()
newton_iteration()

Level 3:

Setup constraints for the system.

get_physical_face_points()
add_interface_constraints()
make_flux_constraints()
update_constraints()
set_interface_dofs_flag()