Main differences from the original source files

par_ini.d

```
1  ###########################################################
2  ##   parameters for COSMOS code          ##########
3  ##   ver1.00 by Chulmoon Yoo             ##########
4  ###########################################################
5  999999          # maximum step of the main loop
6  400.            # maximum time to evolve
7  3               # tab number of the bufer grids
8  10.             # amp
9  -60             # minimum grid number of x =-nmax-1
10 60              # maximum grid number of x =imax/2-1
11 0               # minimum grid number of y
12 60              # maximum grid number of y
13 0               # minimum grid number of z
14 60              # maximum grid number of z
15 -1.             # minimum coordinate of x
16 1.              # maximum coordinate of x
17 0.              # minimum coordinate of y
18 1.              # maximum coordinate of y
19 0.              # minimum coordinate of z
20 1.              # maximum coordinate of z
```

```
1  ###########################################################
2  ##   parameters for COSMOS code          ##########
3  ##   ver1.00 by Chulmoon Yoo             ##########
4  ###########################################################
5  3               # maximum step of the main loop
6  75.             # maximum time to evolve
7  3               # tab number of the bufer grids
8  10.             # amp
9  -36             # minimum grid number of x =-nmax-1
10 36              # maximum grid number of x =imax/2-1
11 0               # minimum grid number of y
12 36              # maximum grid number of y
13 0               # minimum grid number of z
14 36              # maximum grid number of z
15 -1.             # minimum coordinate of x
16 1.              # maximum coordinate of x
17 0.              # minimum coordinate of y
18 1.              # maximum coordinate of y
19 0.              # minimum coordinate of z
20 1.              # maximum coordinate of z
```

simulation max steps and finish time

number of grids 60 → 36

par_ini.d

```
33  ##################################################
34  ###  initial data parameter
35  ##################################################
36  0                 # 0:no continue 1:continue
37  ini_all.dat       # continue file
38  0.50              # amplitude
39  10.               # wave number
40  10.               # xi2 nonsphericity parameter 1
41  0.                # xi3 nonsphericity parameter 2
42  0.                # w3  alignment angle
43  0.                # amplitude for the scalar field
44  10.               # wave number for the scalar field
45  15.               # xi2s
46  0.                # xi3s
47  50.0              # Hubble
```

continue setting

```
33  ##################################################
34  ###  initial data parameter
35  ##################################################
36  1                 # 0:no continue 1:continue
37  ini_all.dat       # continue file
38  0.83              # amplitude
39  10.               # wave number
40  0.                # xi2 nonsphericity parameter 1
41  0.                # xi3 nonsphericity parameter 2
42  0.                # w3  alignment angle
43  0.                # amplitude for the scalar field
44  10.               # wave number for the scalar field
45  15.               # xi2s
46  0.                # xi3s
47  50.0              # Hubble
```

initial amplitude
for the perturbation

nonsphericity parameter ->0

not used in adiabatic_spherical

```
57  ##################################################
58  ###  parameters for output
59  ##################################################
60  0.5               #1st part print interval boundary time
61  0.5               #2nd part
62  100.              #changing time for print interval
```

```
56  ##################################################
57  ###  parameters for output
58  ##################################################
59  10.0              #1st part print interval boundary time
60  10.0              #2nd part
61  100.              #changing time for print interval
```

output interval setting

par_fmr.d

```
1   ########################################
2   ##  parameters for FMR in COSMOS code
3   ##  ver1.00  by Chulmoon Yoo on
4   ########################################
5   ##  maximum number of fmr layers
6   2
7   ##x-grid number for fmr region
8   15
9   25
10  0
11  ##y-grid number for fmr region
12  15
13  25
14  0
15  ##z-grid number for fmr region
16  15
17  25
18  0
19  ##values of the lapse for starting fmr
20  0.15
21  0.1
22  0.
```

```
1   ########################################
2   ##  parameters for FMR in COSMOS code
3   ##  ver1.00  by Chulmoon Yoo on
4   ########################################
5   ##  maximum number of fmr layers
6   2
7   ##x-grid number for fmr region
8   9
9   9
10  0
11  ##y-grid number for fmr region
12  9
13  9
14  0
15  ##z-grid number for fmr region
16  9
17  9
18  0
19  ##values of the lapse for starting fmr
20  0.3
21  0.15
22  0.
```

number of grids covered by a lower layer

lapse at the origin when an additional layer is introduced

cosmos.cpp

```
267    //setting for bools start
268    fld=true;                    // fluid evolution -> true/false
269    scl=true;                    // scalar evolution -> true/false
270    cuev=true;                   // curvature evaluation -> true/false
```

```
381    else
382    {
383        cout << "no continue" << endl;
384
385        //initial data setting start
386        //fmv->set_initial_scalar(mus,kks,xi2s,xi3s);
387        //#pragma omp barrier
388        fmv->initial_nonsph(mu,kk,xi2,xi3,xi2s,xi3s,w3);
389        // fmv->initial(mu);
390        #pragma omp barrier
391        printpack(fmv0,ln,pk,pl,filex,filey,filez,filex0z,filexy0);
392        //initial data setting end
393
394        //printpack(fmv0,ln,pk,pl,filex,filey,filez,filex0z,filexy0);
395    }
396    //reading continue or setting initial date end
```

```
267    //setting for bools start
268    fld=true;                    // fluid evolution -> true/false
269    scl=false;                   // scalar evolution -> true/false
270    cuev=false;                  // curvature evaluation -> true/false
```

no scalar field and curvature calculation

```
398    else
399    {
400        cout << "no continue" << endl;
401
402        //initial data setting start
403        //fmv->set_initial_scalar(mus,kks,xi2s,xi3s);
404        //#pragma omp barrier
405        //fmv->initial_nonsph(mu,kk,xi2,xi3,xi2s,xi3s,w3);
406        fmv->initial_nonsph(mu,kk,xi2,xi3);
407        // fmv->initial(mu);
408        #pragma omp barrier
409        printpack(fmv0,ln,pk,pl,filex,filey,filez,filex0z,filexy0);
410        //initial data setting end
411
412        //printpack(fmv0,ln,pk,pl,filex,filey,filez,filex0z,filexy0);
413    }
414    //reading continue or setting initial date end
```

initial data setting function changed

makefile

```
33  # source file
34  SRC = $(PROG).cpp cosmos_bssn.cpp cosmos_initial.cpp cosmos_output.cpp cosmos_boundary.cpp cosmos_ahf.cpp cosmos_ipol.cpp
    cosmos_fluid.cpp cosmos_fmr.cpp
35  OBJS = $(SRC:%.$(LANG)=%.o)
```

```
33  # source file
34  SRC = $(PROG).cpp ../cosmos_bssn.cpp ../cosmos_initial.cpp ../cosmos_output.cpp ../cosmos_boundary.cpp ../cosmos_ahf.cpp ../cosmos_ipol.
    cpp ../cosmos_fluid.cpp ../cosmos_fmr.cpp
35  OBJS = $(SRC:%.$(LANG)=%.o)
```

- cosmos.cpp is used instead of the original ../cosmos.cpp and ../cosmos_bssn.cpp