```
#ifndef RK4_SOLVER_HH
#define RK4_SOLVER_HH

#include <iostream>
#include <cassert>
#include <vector>
//#define N 1250

class rk4 {
  public:
    bool enable_BH;
    double AA, BB, J, K, h_step, last_h_step, Atol, Rtol, fac, facmin, facmax, T_fin
al,
           dense_stpsze, barnes_theta, minx, maxx, miny, maxy, ox, oy, osint, ocost,
 oid;
    // cidx: Current Index
    // fidx: Futur Index
    int N, n_intvls, not_found, location, cidx, fidx, N_child, step_counter, SIZE_LI
ST;
    double *A, *B, *C, *sc, *x0, *y0, *theta0, *vx0, *vy0, *omega0, *x1, *y1, *theta
1,
           *x1h, *y1h, *theta1h, *vx1, *vy1, *omega1, *sc_x, *sc_y, *sc_theta, *bnod
es_idx,
           *xlim, *ylim, *xlim_next, *ylim_next;
    std::vector<double> barnes_list;
    std::vector<double> bnodes;

    rk4(int N_, double hi_step, double tol, double J_, double K_, int n_intvls_, dou
ble barnes_theta_, bool enable_BH_){
      N = N_;
      enable_BH = enable_BH_;
      AA = 1.;
      BB = 1.;
      J  = J_;
      K  = K_;
      step_counter = 0;
      n_intvls = n_intvls_;
      not_found = 1;
      barnes_theta = barnes_theta_;
      SIZE_LIST = 11;
      x0 = new double[N];
      y0 = new double[N];
      theta0 = new double[N];
      vx0 = new double [N];
      vy0 = new double [N];
      omega0 = new double [N];
      x1 = new double[N];
      y1 = new double[N];
      theta1 = new double[N];
      x1h = new double[N];
      y1h = new double[N];
      theta1h = new double[N];
      sc_x = new double[N];
      sc_y = new double[N];
      sc_theta = new double[N];
      xlim = new double[3];
      ylim = new double[3];
      xlim_next = new double[3];
      ylim_next = new double[3];
      bnodes_idx = new double[N];
      Rtol = tol;
      Atol = tol;
      fac = 0.9;
      facmax = 3.;
      facmin = 1./3.;
      h_step = hi_step;
      last_h_step = hi_step;
      A = new double[10];
      B = new double[9];
      C = new double[5];
      for(int i=0; i<10; i++){
        switch(i){
          case 0: A[i]=1./3.;
```

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                    B[i]=1./8.;
                    C[i]=0.;
                    break;
            case 1: A[i]=-1./3.;
                    B[i]=3./8.;
                    C[i]=1./3.;
                    break;
            case 2: A[i]=1.;
                    B[i]=3./8.;
                    C[i]=2./3.;
                    break;
            case 3: A[i]=1.;
                    B[i]=1./8.;
                    C[i]=1.;
                    break;
            case 4: A[i]=-1.;
                    B[i]=1./12.;
                    C[i]=1.;
                    break;
            case 5: A[i]=1.;
                    B[i]=1./2.;
                    break;
            case 6: A[i]=1./8.;
                    B[i]=1./4.;
                    break;
            case 7: A[i]=3./8.;
                    B[i]=0.;
                    break;
            case 8: A[i]=3./8.;
                    B[i]=1./6.;
                    break;
            case 9: A[i]=1./8.;
                    break;
            default: break;
          }
        }

    };
    void initialize();
    void compute_solution(double T_final_);
    void compute_xx(double t_, double* x_, double* y_, double* theta_, double* outpu
tX, double* outputY, double* output_theta);
    void compute_Gs(double t, double* Gs_x, double* ff_x, double* Gs_y, double* ff_y
, double* Gs_theta, double* ff_theta);
    void compute_y1y1h(double t, double* Gs_x, double* ff_x, double* Gs_y, double* f
f_y, double* Gs_theta, double* ff_theta);
    void dense_output(double t_);
    void hermite(double actual_t, double myTheta, char* filenameDense);
    void nextStep();

    void zap(double* myArray){
      {assert(myArray!=NULL);}
      delete [] myArray;
      myArray = NULL;
    };
    void terminate(){
      zap(x0);
      zap(y0);
      zap(theta0);
      zap(x1);
      zap(y1);
      zap(theta1);
      zap(x1h);
      zap(y1h);
      zap(theta1h);
      zap(vx0);
      zap(vy0);
      zap(omega0);
      zap(sc_x);
      zap(sc_y);
      zap(sc_theta);
      zap(A);
      zap(B);
```

```
      zap(C);
      zap(xlim);
      zap(ylim);
      zap(xlim_next);
      zap(ylim_next);
      zap(bnodes_idx);
      //std::cout<<"Class successfully terminated.\n";
    };
    void barnes_compute(int cidx_, int &i, double xi, double yi, double thi,
                        double &sumx, double &sumy, double &sumtheta, int &N_comp,
double lgth);
    void smart_compute_xx(double t_, double* x_, double* y_, double* theta_,
                          double* outputX, double* outputY, double* output_theta );
    inline void init_lims();
    void find_square(double x, double y, bool nlim);
    inline void push_node(int i, double x_, double y_, double sint_, double cost_);


};

#endif
```