

init solve

$$Ax = b \Rightarrow LUx = b$$

A LU ~~new-matrix~~ LU fact repeat backsub w/ b_i

Heritable factorized

$$\text{cache} = \text{init}(\text{prob}, \text{alg}) \quad A^{(p)}x = b$$

\Rightarrow solve!(cache) \rightarrow if not LU, then LU

~~new~~ $A!$ (cache, A) then backsub
~~new~~ $b!$ (cache, b) prec = ~~(p)~~ ICLUC
 $p = (u, p, t)$

~~new-matrix~~ $\text{set-p}!(\text{cache}, p)$ \boxed{S}
 $\text{update-prec}!(\text{cache}, \text{left/right})$

$$A = QSQ^T \quad \text{or } LHL^T$$

$$rI + A = Q(S + rI)Q^T$$

Root Problem Linear Problem(A, b, $\gamma = \text{false}$)

Shifted Linear Problem(A, b, δ) mass-matrix = I



$$u' = f(u)$$

$$J = J_1 J_2$$

$$(I - \delta J_1)(I - \delta J_2) = I - \delta J_1 - \delta J_2 - \delta^2 J_1 J_2$$

ADI = Alternating Direction Implicit

$$\Delta = D_x D_y u$$

Linear Problem(A, b, p, ^{u0} ~~pp~~ = nothing)

Solve(... ; abstol, reltol

GMRES(... ; prec-right = ...)



What did we make?

Linear Problem(A, b, p, u0 = nothing) ^{kwargs---} \nwarrow *
Shifted Linear Problem(A, γ , b, p, u0 = nothing) = Linear Problem(wcp)

solve(prob, alg, j, reltol, abstol, weights)
_{prec?}

Factorize ^{in cache} : Struct fields:
A factorization PR, PL ^{"nothing"}

cache = init(prob, alg ; kwargs)
_{isfresh}

Prec: it's upto
the alg to
use it or not

set_A!(cache, A)
set_prec!(cache, PR, PL)
set_b!(cache, b)
set_p!(cache, p)

update_prec!(cache) = cache.prec(cache, ...)
_{set_prec!(cache,}

Iterative Solvers, Alg: struct fields
end ^{iterable}

Preconditioner function: (optimal)
@ set cache.prec = f(Val { :int }, cache)

$$f^{\text{proc}}(\text{cache}) \rightarrow (p_l, p_r)$$