

2-D simulations code repository

The code is Written in matlab, extending the SiStER long-term tectonic simulator ([Olive et al., 2016](#)).

Run `SiStER_RUN_script` to launch the simulation with the appropriate input file
(`SiStER_Input_File_damaged_sample_last_westerly.m` for lab-scale simulations or
`SiStER_Input_damaged_sandia.m` for tectonic simulations).

Read `SiStER_Overview.pdf` for material about the SiStER code implementation. The
Implementation of SCAM on top of the original code essentially lies in the following algorithmic flow
chart :

for time = 0 to simulation duration

L: matrix form of discretized Stokes + mass conservation = $f(\text{effective viscosity})$

R: right-hand side of discretized Stokes + mass conservation

S: solution vector, contains v_x , v_y , and P
initially inaccurate, has large residual (res)

while res > tolerance

↑ Set time step Δt to limit the increase of damage at ΔD_{\max}
 $\Delta t < \Delta D_{\max} / (\partial D / \partial t)$

Construct **L** and **R**, using the current solution **S**

Assemble an array of effective viscosity, averaging:

- Viscosity from ductile flow law
- Plastic viscosity (yield stress / strain rate)
- Damage viscosity (from previous stresses and damage)
- Account for elastic terms

Update solution with direct solver: **Snew** = **S** - **L**\b**R**

Calculate residual **res** = $\| \mathbf{L} \mathbf{S}_{\text{new}} - \mathbf{R} \| / \| \mathbf{R} \|$

decrease ΔD_{\max} by 20% every 20 iterations if tolerance is not met
tolerance steadily increases from $1e-7$ to $1e-2$ as iterations progress
limit at 150 iterations

Update damage, elastic stresses

Advect material properties and stresses on markers

end