

1. Triaxial simulation setup  
in LIGGGHTS

Isotropic compressed  
RVE

Top piston movement (choose  $V_p$   
to ensure quasistatic deformation)

Import servo walls, choose  
( $K_p$ ,  $K_I$ ,  $K_d$  and  $V_{servo}$ )

Ensure the convergence of  
confinement stresses ( $\sigma$ )

Choose appropriate timestep( $\Delta t$ )  
(Stable DEM algorithm)

Vary  
PID constants  
or  $V_{servo}$

2. Working of the Servo wall  
(For each timestep)

Apply confinement  
stress( $\sigma$ )

Apply  $\Delta\sigma$  by  
piston movement

Granular sample deform  
with movement of servo walls

Estimation of macroscopic  
granular stress ( $\sigma_g$ ) and  
wall stresses  $\sigma_w(\sigma_1, \sigma_2, \sigma_3)$

$\sigma_w = \sigma$

Yes

Track the servo walls position  
and new piston position  
(Estimation of  $\epsilon_v$  and  $\epsilon_a$ )

Estimate new servo  
wall area ( $A_{new}$ )

Estimate the  $F_{new}$  on the  
servo walls to have constant  $\sigma$

$$F_{new} = \sigma * A_{new}$$

Next  $\Delta t$

