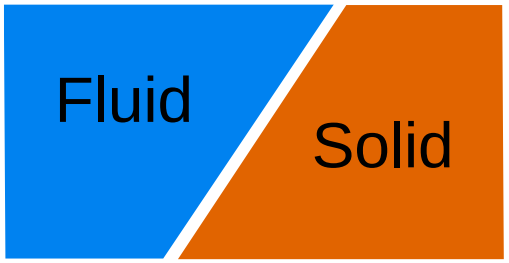
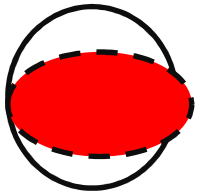
DIMENSIONLESS PARAMETERS



Coordinates	$\underline{x}$	$\underline{x}$	Coordinates
Time	t	t	Time
Velocity field	$\underline{U}$	$\underline{\xi}$	Displacement field
Viscosity	μ	E	Stiffness
Size	L	L	Size
Gravity	g	g	Gravity
Density	ρ	ρ_S	Density
Velocity Data	U_0	ξ_0	Displacement Data

STIFFNESS AND DENSITY

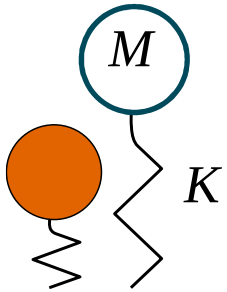
Continuum



E Young's modulus

ρ_S Density

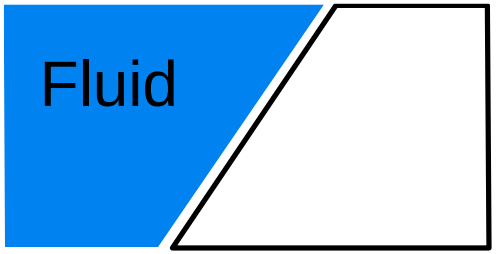
Mass-spring system



$$E = K / L$$

$$\rho_S = M / L^3$$

FLUID ALONE



$$f(\underline{x}, t, \underline{U}, \mu, L, g, \rho, U_0) = 0$$

	$\underline{x}$	t	$\underline{U}$	μ	L	g	ρ	U_0
L	1	0	1	−1	1	1	−3	1
M	0	0	0	1	0	0	1	0
T	0	1	−1	−1	0	−2	0	−1

$$P = N - R = 8 - 3 = 5$$

FLUID ALONE

$$f(\underline{U}, \underline{x}, t, \mu, L, g, \rho, U_0) = 0$$

$$F\left(\frac{\underline{U}}{U_0}, \frac{\underline{x}}{L}, \frac{U_0 t}{L}, \frac{\rho U_0 L}{\mu}, \frac{U_0}{\sqrt{gL}}\right) = 0$$

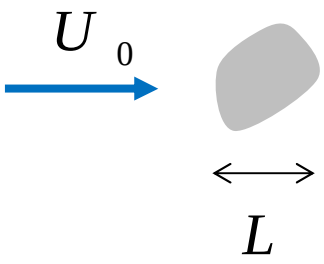
Reynolds number	Froude number
R_E	F_R

FLUID ALONE

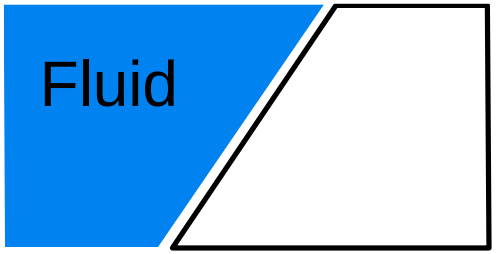
$$F\left(\frac{U}{U_0}, \frac{x}{L}, \frac{U_0 t}{L}, \frac{\rho U_0 L}{\mu}, \frac{U_0}{\sqrt{gL}}\right) = 0$$

$$\frac{U_0 t}{L} = \frac{t}{T_{\text{Fluid}}}$$

$$T_{Fluid} = L / U_0$$



FLUID ALONE



$$F\left(\frac{U}{U_0}, \frac{x}{L}, \frac{U_0 t}{L}, \frac{\rho U_0 L}{\mu}, \frac{U_0}{\sqrt{gL}}\right) = 0$$

SOLID ALONE

$$f(\underline{x}, t, \underline{\xi}, E, L, g, \rho_S, \xi_0) = 0$$

	$\underline{x}$	t	ξ	E	L	g	ρ_S	ξ_0
L	1	0	1	−1	1	1	−3	1
M	0	0	0	1	0	0	1	0
T	0	1	0	−2	0	−2	0	0

$$P = N - R = 8 - 3 = 5$$

SOLID ALONE

$$f(\underline{x}, t, \underline{\xi}, E, L, g, \rho_S, \xi_0) = 0$$

$$F\left(\frac{\underline{\xi}}{L}, \frac{\underline{x}}{L}, \frac{t\sqrt{E/\rho_S}}{L}, \frac{\xi_0}{L}, \frac{\rho_S g L}{E}\right) = 0$$

Displacement number

D

Elastogravity number

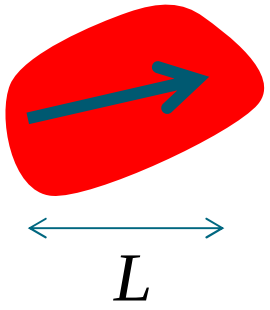
G

SOLID ALONE

$$F\left(\frac{\xi}{L},\frac{x}{L},\frac{t\sqrt{E/\rho_S}}{L},\frac{\xi_0}{L},\frac{\rho_S gL}{E}\right)=0$$

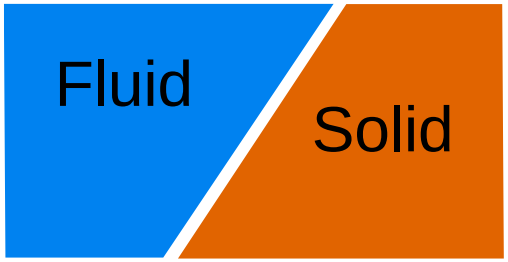
$$\frac{t\sqrt{E/\rho_S}}{L}=\frac{t}{T_{\text{Solid}}}$$

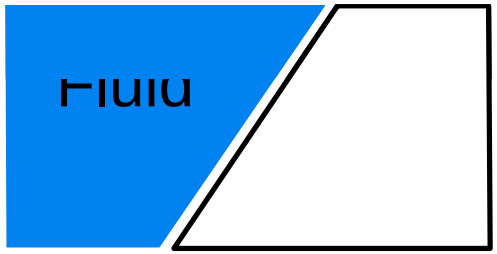
$$T_{Solid}=L/c$$



$$c=\sqrt{E/\rho_S}$$

DECOUPLED FLUID-SOLID INTERACTIONS





R_E

F_R

D

G