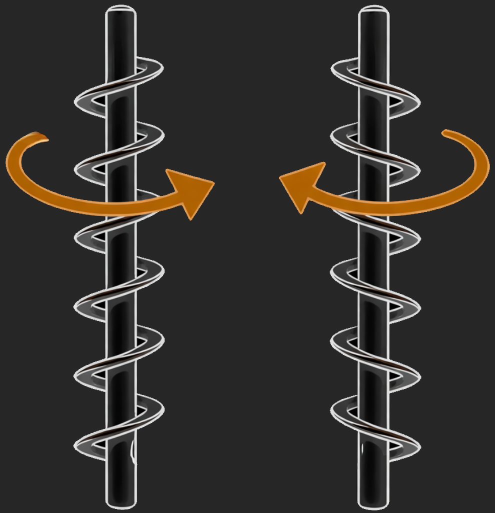
Forces on a diffuser lifting screw



Strand Length

Strand Length

Packing Density

Strand Length

Packing Density

Moisture

Strand Length

Packing Density

Moisture

Fibre Orientation

Fibres

Interlock

Fibres

Interlock

Mat

Fibres

Interlock

Mat

Agglomerate

Density and Moisture

Packs under Pressure

Density and Moisture

Packs under Pressure

More Moisture, More Packing

Density and Moisture

Packs under Pressure

More Moisture, More Packing

More Moisture, More Extraction

Stress and Strain

Diameter

Stress and Strain

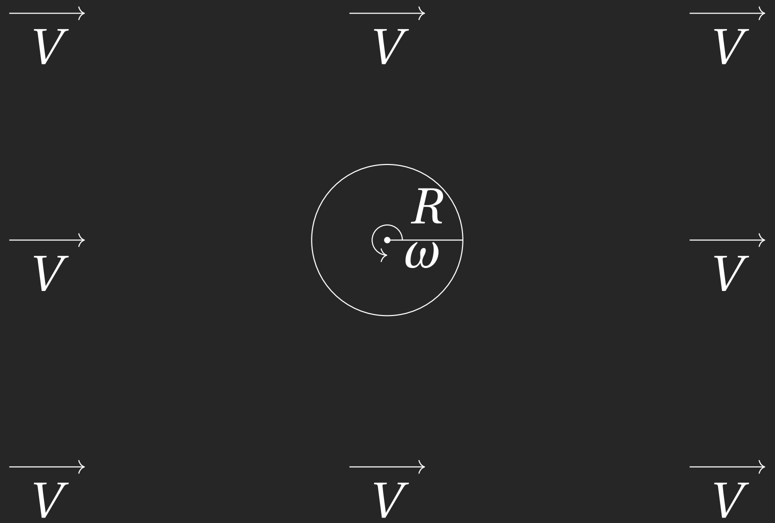
Diameter

Orientation

Stress and Strain

- Diameter
- Orientation
- Connectedness/Linking

Model?



$\vec{V}$
R
ω

Buckingham Pi

If a physical system is described by n dimensional variables involving k independent fundamental dimensions and satisfies $f(q_1, q_2, \ldots, q_n) = 0$, then it can be reduced to $F(\Pi_1, \Pi_2, \ldots, \Pi_{n-k}) = 0$, where the Π_i are $n - k$ independent dimensionless groups.

D - Drag

D - Drag

μ - Dynamic Viscosity

D - Drag

μ - Dynamic Viscosity

V - Velocity of bed

D - Drag

μ - Dynamic Viscosity

V - Velocity of bed

d - Screw Diameter

D - Drag

μ - Dynamic Viscosity

V - Velocity of bed

d - Screw Diameter

ρ - Density

$$\Pi_1 = F(\Pi_2)$$

$$D = V^2 \mu F\left(\frac{Vd\rho}{\mu}\right)$$

$$D = V^2 \mu F(Re)$$

$$\Pi_1 = F(\Pi_2)$$

$$D = V^2 \mu F\left(\frac{Vd\rho}{\mu}\right)$$

$$D = V^2 \mu F(Re)$$

$$\Pi_1 = F(\Pi_2)$$

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$$D = V^2 \mu F(Re)$$

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$$D = V^2 \mu F(Re)$$

$$\Pi_1 = F(\Pi_2)$$

$$D = V^2 \mu F\left(\frac{Vd\rho}{\mu}\right)$$

$$D = V^2 \mu F(Re)$$

$$\Pi_1 = F(\Pi_2)$$

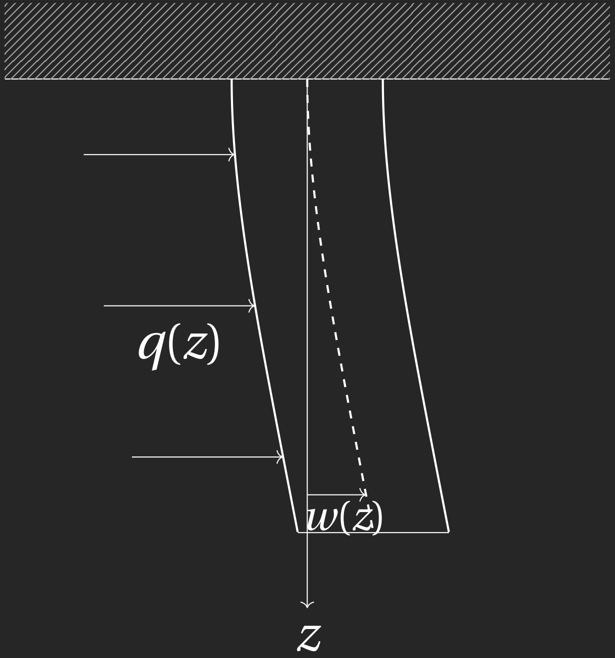
$$D = V^2 \mu F\left(\frac{Vd\rho}{\mu}\right)$$

$$D = V^2 \mu F(Re)$$

$$\mu \nabla^2 \underline{u} - \underline{\nabla} p + \underline{f} = \underline{0},$$

$$\underline{\nabla} \cdot \underline{u} = 0,$$

Stokes Paradox



$q(z)$
$w(z)$
z

$$\frac{\mathrm{d}^2}{\mathrm{d}z^2}\left(EI\frac{\mathrm{d}^2 w}{\mathrm{d}z^2}\right) = q(z).$$

$$S(z) = -\frac{\mathrm{d}}{\mathrm{d}z}\left(EI\frac{\mathrm{d}^2 w}{\mathrm{d}z^2}\right),$$

$$M(z) = -EI\frac{\mathrm{d}^2 w}{\mathrm{d}z^2}.$$

$$\frac{\mathrm{d}^2}{\mathrm{d}z^2}\left(EI\frac{\mathrm{d}^2 w}{\mathrm{d}z^2}\right) = q(z).$$

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$$\frac{\mathrm{d}^2}{\mathrm{d}z^2}\left(EI\frac{\mathrm{d}^2 w}{\mathrm{d}z^2}\right) = q(z).$$

$$S(z) = -\frac{\mathrm{d}}{\mathrm{d}z}\left(EI\frac{\mathrm{d}^2 w}{\mathrm{d}z^2}\right),$$

$$M(z) = -EI\frac{\mathrm{d}^2 w}{\mathrm{d}z^2}.$$

$$z \sim L, \qquad q \sim F, \qquad w \sim \frac{FL^4}{EI},$$

$$z = L\bar{z}, \qquad q = F\bar{q}, \qquad w = \frac{FL^4}{EI}\bar{w}.$$

$$\frac{\mathrm{d}^4 w}{\mathrm{d}z^4} = q(z),$$

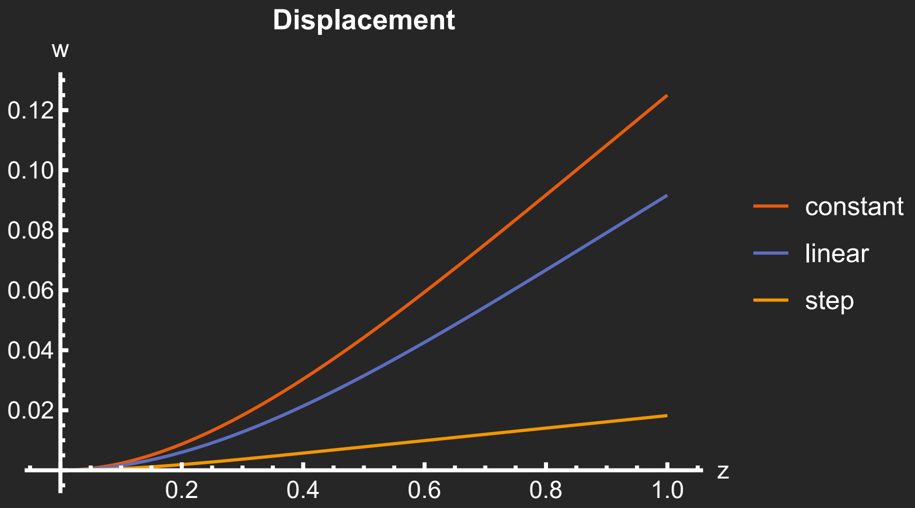
$$w(0) = w'(0) = 0,$$

$$w''(1) = w'''(1) = 0.$$

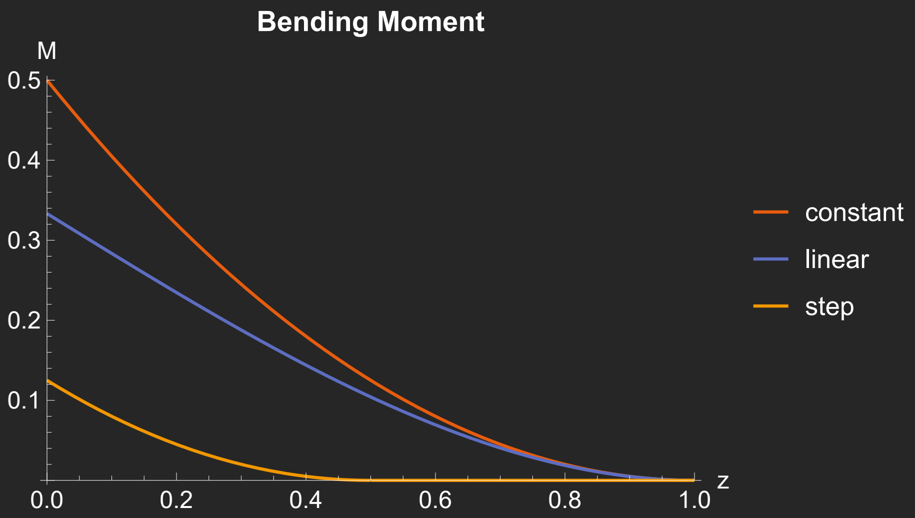
$$w(z) = \int_0^1 G(z;\xi)\,q(\xi)\,\mathrm{d}\xi,$$

$$G(z;\xi) = \begin{cases} \frac{1}{6}z^2(3\xi - z) & z < \xi, \\ \frac{1}{6}\xi^2(3z - \xi) & z > \xi. \end{cases}$$

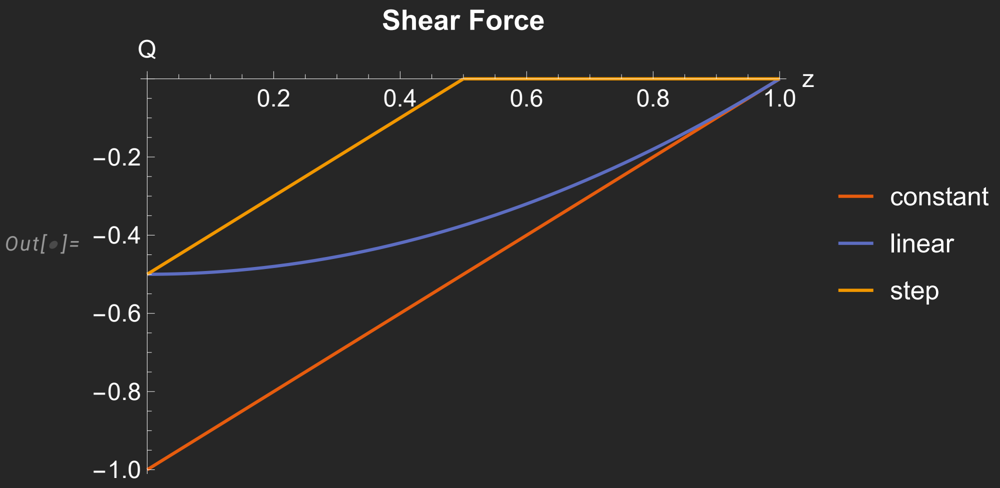
Out[•]=

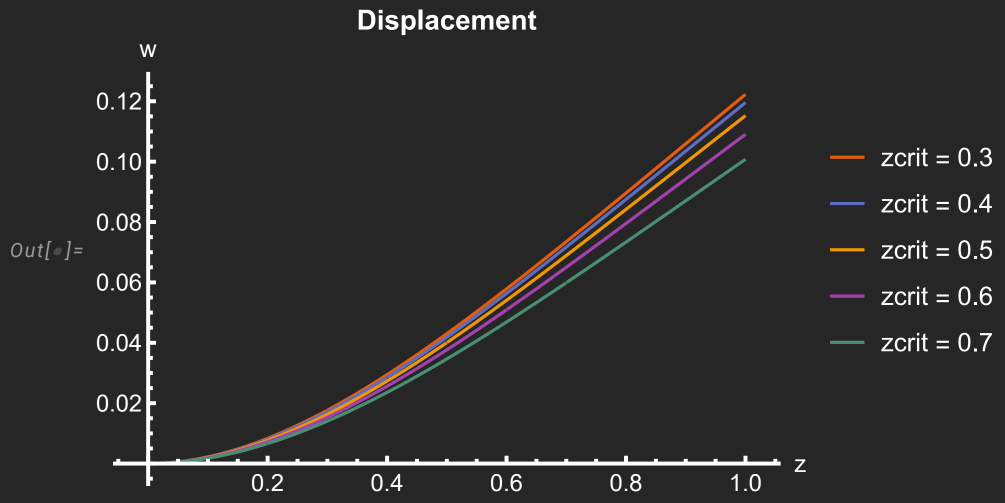

Displacement
w
0.12
0.10
0.08
0.06
0.04
0.02
0.2
0.4
0.6
0.8
1.0
z
constant
linear
step

Out[•]=

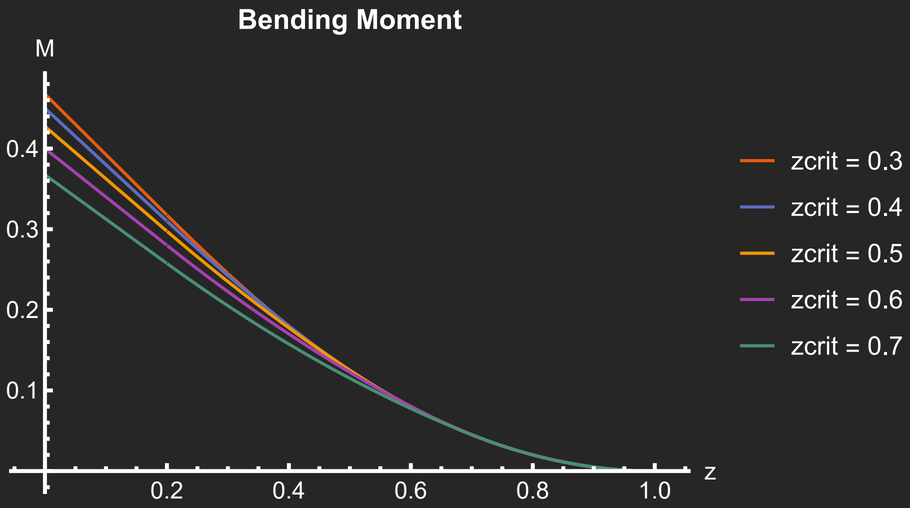


Bending Moment
M
0.5
0.4
0.3
0.2
0.1
0.0
0.2
0.4
0.6
0.8
1.0
z
constant
linear
step


Out[•]=
Shear Force
Q
z
0.2
0.4
0.6
0.8
1.0
−0.2
−0.4
−0.6
−0.8
−1.0
constant
linear
step

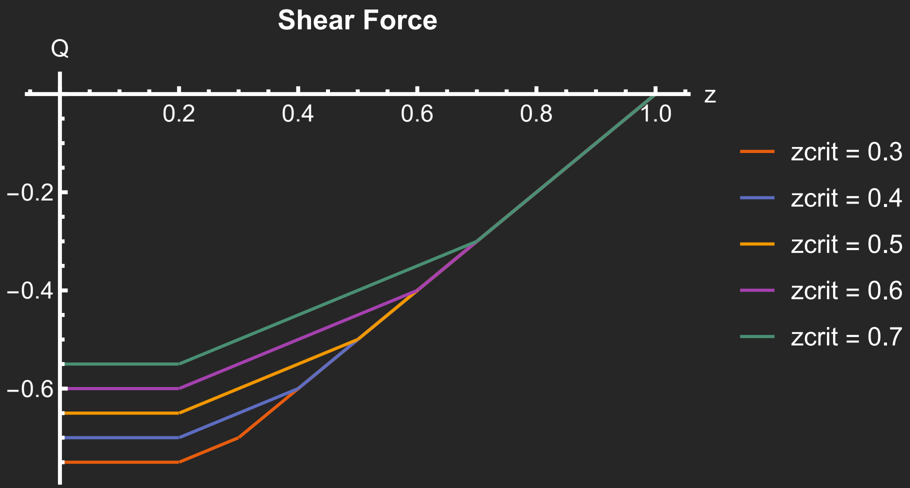

Out[•]=
Displacement
w
0.12
0.10
0.08
0.06
0.04
0.02
0.2
0.4
0.6
0.8
1.0
z
zcrit = 0.3
zcrit = 0.4
zcrit = 0.5
zcrit = 0.6
zcrit = 0.7

Out[•]=



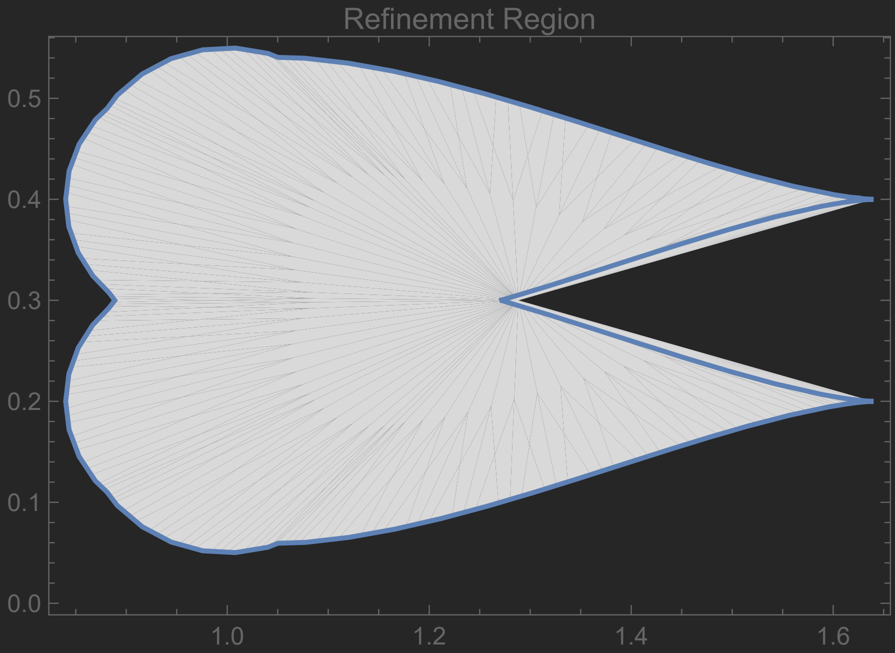
Bending Moment
M
0.4
0.3
0.2
0.1
0.2
0.4
0.6
0.8
1.0
z
zcrit = 0.3
zcrit = 0.4
zcrit = 0.5
zcrit = 0.6
zcrit = 0.7

Out[•]=


Shear Force
Q
z
0.2
0.4
0.6
0.8
1.0
−0.2
−0.4
−0.6
zcrit = 0.3
zcrit = 0.4
zcrit = 0.5
zcrit = 0.6
zcrit = 0.7

Out[●]=

Out[●]=



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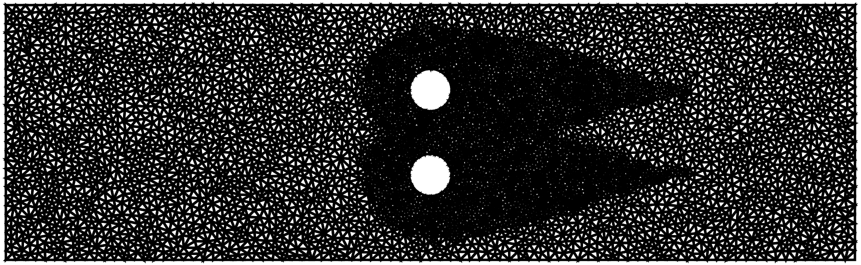

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