

# Effective slip lengths for Stokes flow over rough, mixed-slip surfaces

PhD Defense Presentation


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So it begins...

# Limitations of Homogenization



A diagram showing a rectangular domain  $\Omega$ . The top boundary is dashed and labeled  $\Gamma_0$ . The bottom boundary is solid and labeled  $\Gamma_b$ . The domain is labeled  $\Omega$  in the center.

$$\nabla^2 u = f \quad \text{on } \Omega$$
$$u = b \frac{\partial u}{\partial n} \quad \text{on } \Gamma_b$$

Multiply by test function  $g$  and integrate over  $\Omega$ :

$$\int_{\Omega} g \nabla^2 u = \int_{\Omega} g f \quad (1)$$

Use vector identity and divergence theorem to get:

$$\int_{\Gamma} g \frac{\partial u}{\partial n} - \int_{\Omega} \nabla u \cdot \nabla g = \int_{\Omega} g f \quad (2)$$

The slip condition on  $\Gamma_b$  implies:

$$\frac{\partial u}{\partial n} = \frac{1}{b}u \quad (3)$$

Substitute this, to get variational form:

$$\int_{\Gamma_b} g \frac{1}{b} u - \int_{\Omega} \nabla u \cdot \nabla g = \int_{\Omega} g f \quad (4)$$