# Asymmetric streaming induced by large amplitude vibrations near a sharp obstacle

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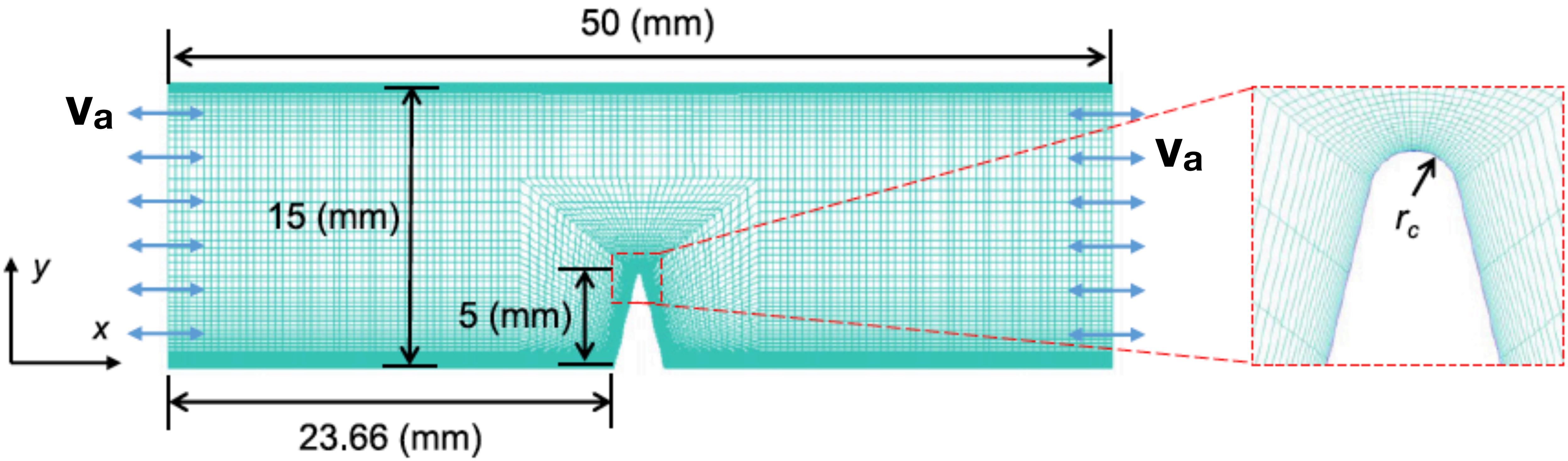

Classical framework computes an effective streaming force $F_s$ :

$$(\mathbf{v}_s \cdot \nabla)\mathbf{v}_s = \mathbf{F}_s - \frac{1}{\rho}\nabla p_s + \nu\nabla^2\mathbf{v}_s \quad \text{with:} \quad \mathbf{F}_s = -\frac{\rho}{2}\langle Re[(\mathbf{v}_a \cdot \nabla)\mathbf{v}_a{}^*]\rangle$$

+ time-periodic eq°: $$i\omega\mathbf{v}_a + (\mathbf{v}_s \cdot \nabla)\mathbf{v}_a + (\mathbf{v}_a \cdot \nabla)\mathbf{v}_s = -\frac{1}{\rho}\nabla p_a + \nu\nabla^2\mathbf{v}_a$$

If $v_s$ is small enough, diffusive term dominates : $$v_{s,max} \sim \frac{\delta^2}{\nu r_c} v_a^2$$

At larger forcing, all non-linear terms hold : simulate complete NSE

Two main findings :
- the quadratic dependence holds only in a limited range (low values) of $v_a$
- at large enough $v_a$, , the streaming flow becomes left-right asymmetric