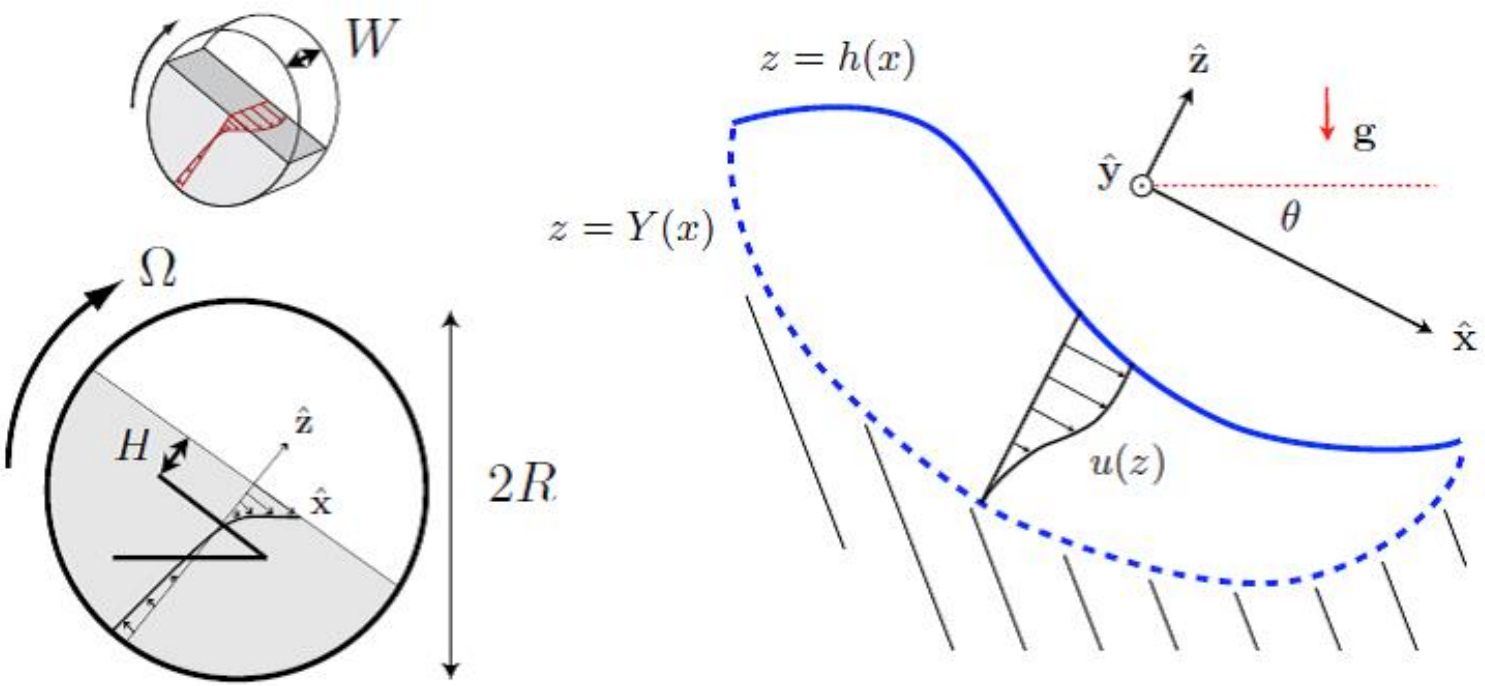
Shaking Seeds - Fluid/Impact Modelling

February 1, 2017

Fluid Model I



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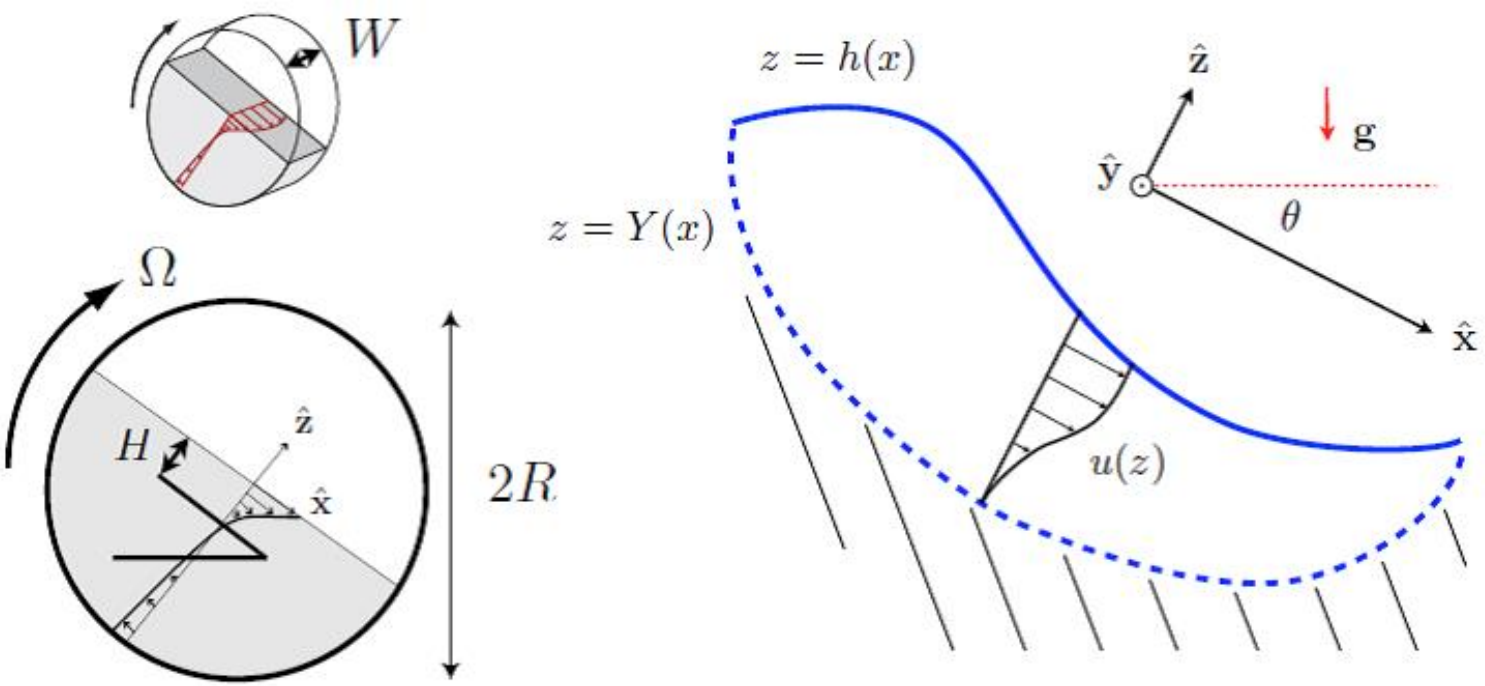

Advection Diffusion Equation

$$\frac{\partial c}{\partial t} + (\mathbf{u} \cdot \nabla) c = D \nabla^2 c$$

Fluid Model II

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- Assume an incompressible fluid

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$$\nabla \cdot \mathbf{u} = 0$$

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- Separate the flow into two major regions:
  1. Rigid body rotation
  2. Constant flow

Fluid Model II

- Assume an incompressible fluid

Incompressible Continuity Equation

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- Separate the flow into two major regions:
  1. Rigid body rotation
  2. Constant flow
- Use stream functions to model the flow in these regions

Fluid Model II

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Incompressible Continuity Equation

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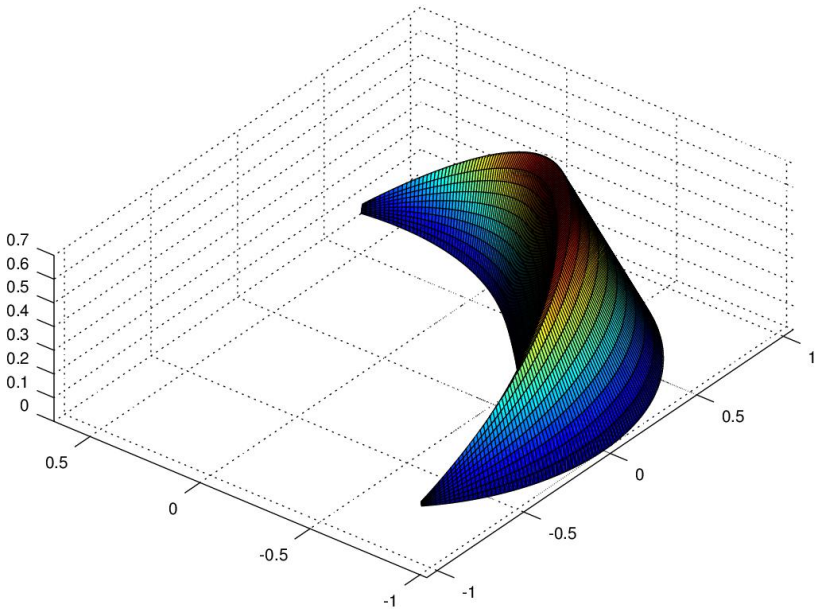
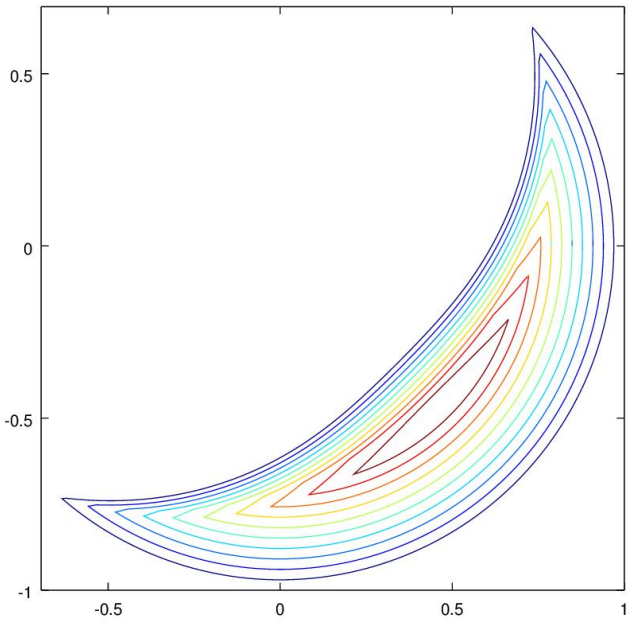
- Separate the flow into two major regions:
  1. Rigid body rotation
  2. Constant flow
- Use stream functions to model the flow in these regions
- Smoothing techniques on the boundary between the regions

Fluid Model III





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SDE

$$dX_t = \begin{pmatrix} \psi_y \\ -\psi_x \end{pmatrix} dt + f(\omega) dW_t$$

Diffusion

- Conisder particles moving together with some randomness
- At Δt, probability $p\Delta t$ of collision
- Lose some proportion of concentration μc
- On average, lose $p\Delta t\mu c$

Diffusion

$$\frac{\mathrm{d}c(t)}{\mathrm{d}t} = \mu p \lambda \nabla^2 c$$

- Vorticity may depend on μ