5. Energy extraction

\[ \nabla \times \mathbf{u} = \frac{1}{\rho} \frac{\partial \mathbf{p}}{\partial z} \]

\[ \text{Exchange with front (potential + kinetic)} \]

\[ E = \frac{1}{2} \left| \mathbf{u} + \mathbf{b} \right|^2 + \frac{1}{2} \left| \mathbf{u} \right|^2 \]

\[ \text{Exchange ratio: } R_e = \frac{\left| \mathbf{u} + \mathbf{b} \right|^2}{\left| \mathbf{u} \right|^2} \]

6. How robust is this process?

- Linear and non-linear backward reflections are similar.
- Linear and non-linear forward reflections are very different.
- Backward reflections do not favour triadic resonances (cf. messy arrow sketch).
- Forward reflections do.
- Triadic resonances trigger weak, then full, turbulent-like cascades.
- Smaller scales propagate slower, pin down energy under the surface, and dissipate: increase Ri.

Non-linear effects:

- Non-linearly interacting incident and reflected waves create frequencies $\omega_{\text{incidence}}$.
- Forward reflections: shallow $k$, steep $\epsilon$, resonances favoured.
- Backward reflections: steep $k$, shallow $\epsilon$, resonances unlikely.

References: