Numerical Investigation of Wave Turbulence in an Elastic Plate

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Wave Turbulence of flexural waves in elastic plates poses problems: experimental power spectra do not follow the theoretical predictions.
Discrepancies may be addressed in terms of:

- Damping effects;
- Finite Box limit effects;
- Incorrect separation of linear and nonlinear time scales,

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The idea is to develop a numerical scheme as close as possible to a real experiment.

Finite difference Code in physical space.

- Conservation of energy;
- Pointwise, sinusoidal forcing forcing;
- Physical boundary conditions;
- No damping.

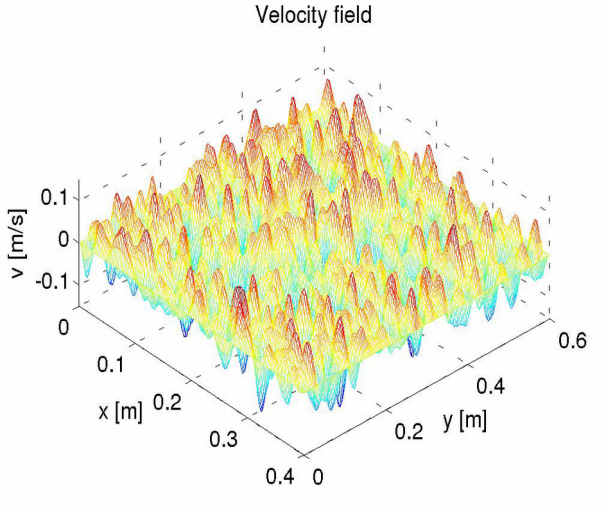

Fig 1. Turbulent Velocity Field Obtained from the FD scheme.

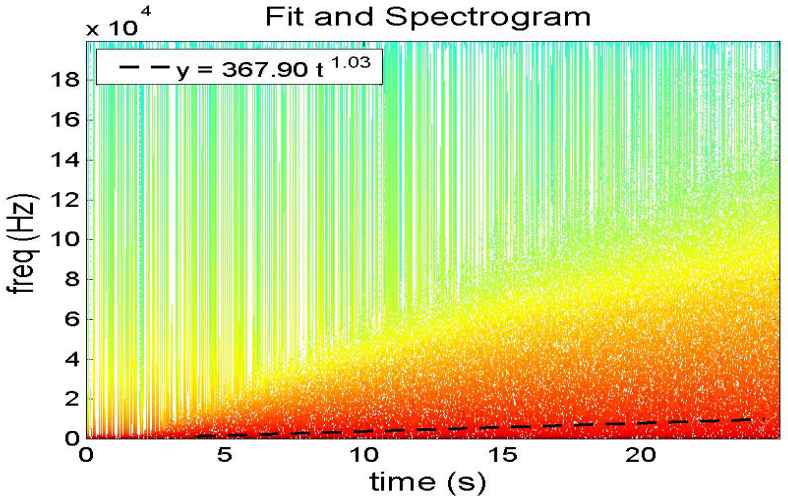

Fig 2. The absence of damping permits the observation of an energy cascade through lengtscales,

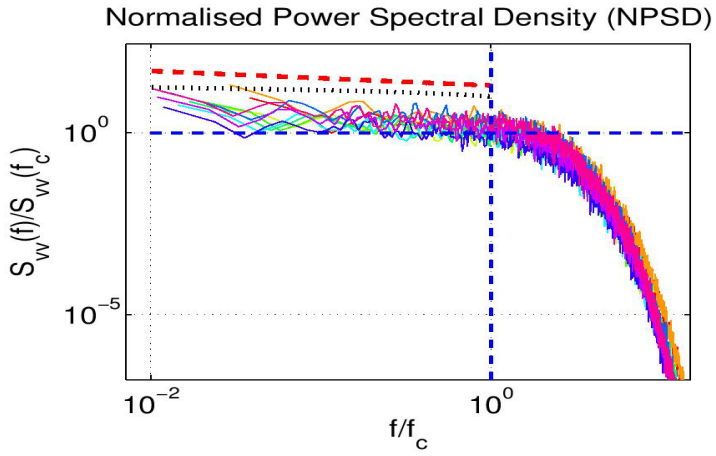

Fig 3. The PSD from undamped simulations present a slope which is not too different from the theoretical log-correction,

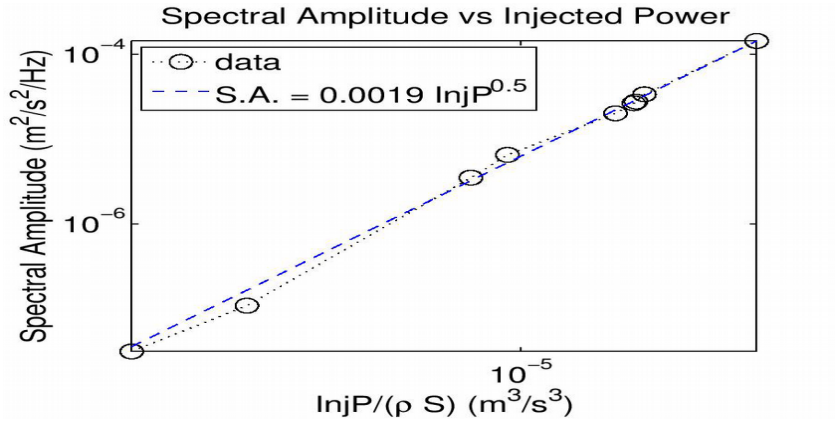

Fig 4. The spectral amplitude goes as the squre root of the injected power. This contradicts the theory.

Conclusions:

- Preliminary results show that the undamped spectra resemble the theoretical ones, thus damping effect may be responsible for the change of the spectra slope.
- The spectral amplitude as a function of the injected power does not follow the theory, but is an agreement with the experiments.

Future work:

- Add damping
- Add Imperfections (always present in a real plate)