ENR-NAT videoconference discussion on bicoherence, memo

Date: 2018-01-10 14:00-15:00
Place: videoconference (IPP Garching, ENEA, BME)
Participants: Gergő Pokol, Gábor Por, Ors Asztalos, Fulvio Zonca, Philipp Lauber, Francesco Palermo, Xin Wang, Gergely Papp, Peter Zsolt Poloskei, Zhixin Lu,
Recorded by: Peter Zsolt Poloskei (pepo@ipp.mpg.de)

Aim: Discuss details of the feasibility of bicoherence calculation on turbulence related signals

- Questions from the signal processing side were presented by Gergő Pokol, such as:
  - Q: Why do we use Fourier-transform based methods for turbulence studies?
    - A: Narrow band modes are expected; weak turbulence theory describes a narrow frequency band where unstable modes can appear, bicoherence analysis is expected to be applicable.
    - Bicoherence analysis should be tested with control cases (with and without turbulence + wave coupling) from numerical simulations.
  - Q: Why do we study the quadratic nonlinearity?
    - A: Weak turbulence theory shows that quadratic nonlinearities expected to be the lowest order most significant nonlinearity. Plus, higher order coherences are increasingly harder to interpret.
- Experiments focusing more on core ES turbulence in 2018 at AUG, hopefully will provide useful further more data for analysis purposes.
- Ideas regarding signal generation from numerical simulations also discussed.
  - Summing over radial position and different (m,n)s is a reasonable approach.
  - Additional white noise required to avoid numerical issues during bicoherence calculation (e.g. phase coupling caused by spectral leakage).
  - Bicoherence value converges from 1, therefore a reasonable number of averages is needed (sets the suggested length of the numerical simulation). Determining optimum parameters is a complex issue, and this question will be discussed in a separate set of recommendations.