MEK4600/9600: WaveLab

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1 PIV measurements of period waves

For this assignment PIV measurements of surface waves will be conducted and compared with a suitable mathematical model, e.g. Stokes waves theory. The goal is to find and generate weakly nonlinear surface waves and measure the elevation and kinematics.

The setup consists of a PIV system; CMOS camera, with a 2400×1700 pixel resolution at 168 fps. White light (LED) will be used to generate a light sheet and 50 μm polyamid spheres should be used as tracer particles. The processing should be performed using a open src PIV code. Remember; each particle should cover $2-4$pixels and a minimum of four particles must be inside each interrogation area. A focus on high image quality is important to achieve as high accuracy as possible in the post processing.

Please follow these steps;

1. Generate waves with frequency $1.425Hz$
2. Find an appropriate amplitude which generates a deep water Stokes waves - $A = 0.01V, 0.1V, 0.2V$ and $0.3V$. Remember to check kh and ak. Elevation must be measured and compared to theory. Also compare the two different probes and find an error estimate.
3. When the amplitude and frequency are found then velocities should be measured. Make three repetitions.
4. Make a direct comparison of the velocity field and also velocity profiles below the crest.
5. A linear wave should also be found and compared with linear theory - remember three repetitions.
6. Comment on accuracy and difficulties in the measurements.
7. To avoid outliers at the free surface the raw images should be masked - put zeros above the free surface.