WEEG NEWSLETTER January 2020

The newsletter is published monthly by the University of Southampton's Water and Environmental Engineering Group WEEG, and reports things of interest in this field worldwide, as well as ongoing undergraduate student and research work in WEEG itself.

We believe that water and energy are the most important topics worldwide for the next decades. Our work covers river and coastal engineering, water and wastewater and energy related to water.

Editorial: water has many uses, and one of them was defence. In fact, water was so important in this field that a lot of hydraulic engineering evolved around the design and implementation of defence works.

Hydraulic Engineering International: *water in defence.*

Some time ago we had an editorial about water as a weapon, which today can be just as powerful as it was a long time ago. Cutting off the water supply from the enemy is a very powerful persuader. However, water was also used in defence and Fig. 1 shows what we would classically envisage when talking about this topic: a water filled moat around a medieval castle (or city).

Fig. 1: Caerlaverock Castle, Scotland

With the advent of artillery, castles and stone walls became obsolete and a new style of fortification, based on scientific principles, was developed: the Italian Style.

Fig. 2: Palmanova, Friuli / Italy

The Italian style fortifications are characterised by artillery platforms or bastions, which are designed to protect each other through flanking fire. Palmanova, shown in Fig. 2 is a city in Northern Italy that still has its fortification, including a water-filled moat. In the late 17th and the 18th Century, however, the principle was adapted by Dutch engineers, who took it to a new level of complexity; and thereby provided a very large impetus to the development of hydraulic engineering

Fig. 3: Bourtange / Netherlands

Bourtange in the Netherlands is a good example of the Dutch style, with a triple-layered moat between the outer glacis, the ravelin and the inner ring of bastions. The Dutch scientist and engineer Simon Stevin was a designer of such fortifications: he did that in between discovering the hydrostatic paradoxon, employing the use of sluices for defence and describing the resolution of forces in vector parallelograms.

Fig. 4: Bourtange, view from ground level

The star-shaped fortifications are beautiful viewed from the air. From the ground, however, you can hardly perceive anything of the complex geometries, as Fig. 4 shows. It is easy to imagine that the design of such fortifications was the task of highly skilled engineers. In fact, our word for civil engineering comes from that time. We are

called civil engineers not because we are all exceedingly polite, but to differentiate the engineer dealing with civil works from the one who designs military works.

In some cities you can still see the remainders of the old fortification, see Fig. 5.

Fig. 5: Fortification of Braunschweig/Germany, 1761 and 2020.

The wet ditch here surrounds the city centre as a zig-zag shaped, water-filled trench. There are several weirs, which are necessary to maintain the water levels: so there was quite a bit of hydraulic engineering going into the design of the system.

New measurement technology: *Pressure measurement with lasers*

Conventional ways of measuring fluid pressure in hydraulics are either non-local or intrusive. For example, think of a Pitot tube, which is local but intrusive; or piezometer tubes, which are non-intrusive but give you the pressure at the wall containing the fluid (and thus, they are non-local).

For some applications this is more than enough. However, Xinyang Ge (PhD student) is trying to push the boundaries of experimental hydraulics by developing a technique to sample local fluid pressure in a fully non-intrusive manner, by making use of well-established tools in optical metrology.

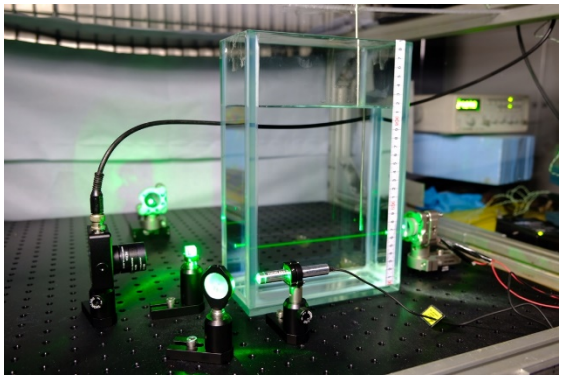


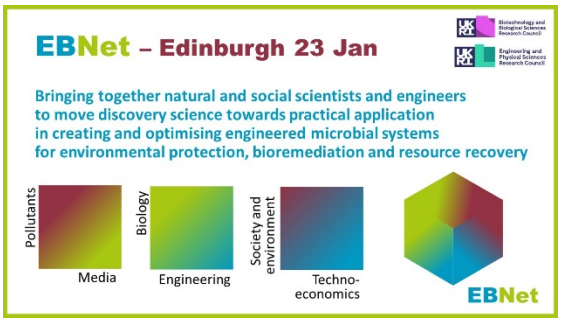
Fig. 6: A laser beam passes through a water tank, after which it is combined with another beam and their interference is recorded

The technique splits a laser beam in two and then looks at the interference pattern when the two beams are recombined (see Fig. 6). The interference depends on the refractive index of water, which changes with pressure (and temperature). This technique may be used, for example, to calibrate other state-of-the-art techniques to sample pressure, such as Particle Image Velocimetry (which we have discussed before: see Feb and Oct 2019 editions at https://hydro.soton.ac.uk/resources/newsletters).

If you want to find out more or even get involved (e.g. for your IP) please contact Dr Sergio Maldonado (s.maldonado@soton.ac.uk).

EBNet national event:

Researchers and professionals interested in water and wastewater treatment, contaminated land and pollution remediation can come along to the Environmental Biotechnology Network www.ebnet.ac.uk event in Edinburgh on 23 Jan.



Register at www.eventbrite.co.uk/e/the-environmental-biotechnology-network-ebnet-research-colloquium-2020-tickets-78144292683 or contact EBNet@ebnet.ac.uk

Jobs in water engineering:

This section gives you an idea of the type of work you can do when working in industry.

Advert: Hydrology is vital to all aspects of engineering and always has good jobs:

Senior Engineer (Hydrologist)

https://www.unitedutilities.com/corporate/careers/current-vacancies/#page_id=ss_job_display&page_key=13423.1

Civil and Environmental Engineering at Southampton University:

WEEG: the Civil and Environmental Engineering pathway offers the chance to deepen your knowledge in water-related areas, and gives you a better preparation for environmental engineering projects.

Contact: Dr Sonia Heaven, s.heaven@soton.ac.uk, Bldg. 178, Room 5008

Further information:

We have two Facebook pages, which provide a logbook of our laboratory activities:

www.facebook.com/Hydraulicslaboratory/

www.facebook.com/environmental.lab.university.of.southampton/

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