Physical Separation and Multiphase Research Group

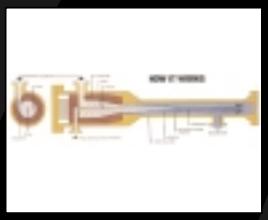
Department of Mechanical Engineering

Active since the late 1970s, the group has concentrated on developing compact and robust separation technology, principally for the offshore oil industry, but more recently, also for the food and process industries. Whilst the focus of the research has been liquid/liquid separation in hydrocyclones, a variety of other devices have been developed including granular media and electrostatic coalescers and gravitational effect separators. In carrying out this work, a wide range of flowing systems have been quantitatively examined (gas-liquid, solid-liquid and multi-phase) and related process engineering problems, such as fluid borne particle erosion, also studied.

The development of the world's first effective hydrocyclone for removal of contaminant oil from water led to numerous patents and extensive commercialisation with cumulative worldwide sales standing at almost $150M .

The work also received the Norsk Hydro Prize for water quality enhancement in 1991 and the Prince of Wales Award for Innovation in 1992 (Special Category for work in an HEI).

Facilities

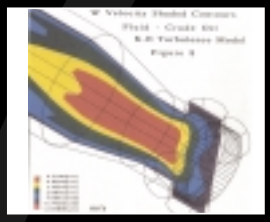


Facilities include a number of well equipped test rigs incorporating instrumentation for determining separator residence time distributions and internal velocity fields (laser anemometry) as well as particle (drop) concentration and size measurement. Significant work has also gone into developing techniques for achieving controllable and reproducible test conditions for unstable media e.g. liquid-liquid systems. The linking of experimental to analytical / numerical methods is a key activity and is backed by a CFD modelling capability.

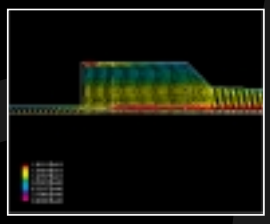
Research areas

- Liquid / liquid hydrocyclones
- Mathematical modelling
- Erosion of choke valves
- Electrocoalescers
- Biological applications of hydrocyclones
- Fluid and separation technology
- Pipe freezing

Recent Work



- The development of a rapid through-flow electorstatic compact coalescer for dewatering of crude oil
- Computational anaysis of de-watering hydrocyclones on off-shore oil rigs
- Characterisation of two and multi-phase systems and their controlled reproduction and measurement under laboratory conditions, especially oil / water mixtures.
- LINK Surface Engineering Programme - research into CVD and HVOF coatings for subsea choke valve applications.
- US Navy - understanding the processes of charge generation in gear contacts as a predictive maintenance tool.
- DRA / UoS - corrosion studies using SRET (Scanning Reference Electrode Techniques) of thin ceramic and epoxy films for marine applications.
- Development of both numerical and semi-analytical methods for predicting the stresses induced in pipes as a result of the freezing process.
- Mathematical modelling of industrial processes: including currently the two-phase flow of carbon paste in the production of electric smelting electrodes.
- Mathematical modelling of eyes after retinal detachment: in particular convection in the anterior and posterior segments of the eye and the behaviour of eyes containing gas bubbles during civil aircraft flight.
- Multiphase flow: in particular boiling annular flows, bubbly flows and loss of hyperbolicity in two-phase flow models.



This article may be found at http://www.soton.ac.uk/~mechwww/sep/welcome.html

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