

Control system for slug mitigation

Our ref no: 4760

Background

Slugging occurs in pipelines carrying gas-liquid mixtures. In such flows, liquid continuous regions ('slugs') flow along the pipe separated by gas dominated flow. Severe slugging in well risers can be extremely disruptive and costly to the operator through reduced oil well production. Large slugs can upset or even damage process equipment which will impact on production and recovery rates. Very severe slugging can even lead to wells being abandoned prematurely.

Imperial Innovations is commercialising a novel technology, developed at Cranfield University, which detects and controls slugs to minimise the impact on the processing facility and on production rate. Installation costs are very low because the software based controller uses information from sensors normally already installed on the production rig platform (augmented by a non-invasive instrument if required) via existing SCADA.

Technical Features

The software analyses signal fluctuation (pressure, temperature, separator level and flow rate) from the topside processing facility. It operates with an automated choke valve as it uses the method from the controller to operate the valve at the exit of the riser, to ensure that the fluctuations are maintained at acceptable levels.

The technology was developed as part of a project on enhanced brown field recovery. It has been demonstrated at Cranfield using a 11m high riser facility, which is managed by Emerson's DeltaV plant management system. The slug controller is implemented in a laptop PC which interfaces with the DeltaV.

Benefits

The cost of implementing the Cranfield software is offset by the key economic benefits of improved production and extended field life. For the average oil well using the software could increase production by over 400 barrels a day and nearly 150,000 per year.*

* Calculations based on the average US oil well productivity in 2007 of 10,200 barrels per day per well.

For further information on this technology please contact:

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Off-shore oil rig

In contrast to other technologies, the present method uses only data from the topside facility and it does not require additional instrumentation down the well. Also there is no need for additional hardware such as a pre-separator.

Existing slug control techniques try to maintain a perfectly steady condition result in imposing large pressure loss across the choke valve, which could seriously restrict production rate. The new technology allows a certain degree of fluctuation and by recognising the capacity of the processing facility minimises the controller impact on production.

Adoption of this technology will lead to better equipment integrity and process control and will reduce flare and environmental impacts.

Application

The system is designed to improve the production of oil and gas. It can interface with existing plant SCADA and control systems.

IP Development Stage

The technology has been verified using Cranfield's high riser. In addition, computer simulation studies have been undertaken using a typical production flow line riser model with encouraging results. Further testing in the field is required to progress the system from a concept to a commercial application. Companies interested in the technology are invited to contact Imperial Innovations.

Cranfield University

Dr. Hoi Yeung

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About Cranfield University

Cranfield University is a distinctive, wholly postgraduate and forward thinking institution where world-class research and innovation leads to world-changing solutions. With a global reputation for inspirational teaching and research Cranfield's mission is to transform knowledge into ingenious solutions in science, technology and management.

The Higher Education Funding Council for England has allocated 'quality research funds,' which are linked to industry-funded university research, to Cranfield – a pleasing recognition of the university's superior research and excellent links with industry.

Cranfield works on practical cutting-edge projects with some of the most recognised names in business, including Airbus, Boeing, BP, GlaxoSmithKline, EDS, Nestle, Petrobras, Rolls-Royce, Shell and The Royal Bank of Scotland.

The university has state-of-the-art facilities, many of which are on an industrial scale, to assist its leading people in developing new and innovative approaches to a range of issues affecting business and society. Cranfield has recently added new buildings and facilities including the Cranfield Management Research Institute, spectacular laboratories, offices and teaching space for Cranfield Health, and research facilities in precision engineering.

Imperial Innovations

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About Imperial Innovations

Imperial Innovations provides commercialisation services to Cranfield University. Working in partnership with Cranfield, Innovations leads commercial activity to create new spin-out companies and licence deals.

The company's integrated approach encompasses the identification of ideas, protection of intellectual property, development and licensing of technology and formation, incubation and investment in technology businesses. A wide range of technologies are commercialised within the areas of energy and environment, engineering, healthcare and software and IT.

Imperial Innovations has a number of commercialisation contracts with multinational corporations, research organisations and universities, across a range of sectors, each adding a unique strength to its services. The Innovations' team has developed excellent market knowledge needed for today's fast paced competitive environments.

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