Other - Enabling Process Innovation Through Computation Seminar Series (EPIC)

Displacement and mixing processes in inclined ducts

Ian A. Frigaard, UBC, Vancouver, Canada

Professor, Department of Math & Mech Engineering

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Abstract:

Many oilfield processes involve displacement of one fluid by another, and not only in the reservoir. In oilfield cementing these process flows involve fluids of different density and rheology, displacing along inclined ducts (pipes or annuli) in both laminar and turbulent regimes. Effective design of these processes means us being able to estimate displacement efficiencies and mixing volumes over a wide range of process settings. We outline current efforts to make such estimates that combine a full toolbox of techniques from basic dimensional analysis, through reduced models to more complex computational simulations and laboratory scale experiments. By carefully combining the understanding from these different methods we build our quantitative and qualitative understanding in a systematic fashion. We demonstrate that no one method is king: experimentation and computation work hand-in-hand, but often rely on simpler models and analysis for both their design and interpretation. Equally, although sophisticated methodologies are useful in generating understanding, often the amount and complexity of data generated in a detailed study is prohibitive in giving industrial guidance: simpler answers are needed. Despite all this, good science and interesting fundamental fluid mechanics questions lie under the murky surface of industrial flows!

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Speaker's Bio:

I. A. Frigaard is Professor of Mechanical Engineering and Applied Mathematics at UBC. He received his BSc in Mathematics from Cardiff, M.Sc. and D.Phil in Engineering Science from Oxford University, joining UBC in 2000 after 7 years of postdoctoral research: academically in Austria and industrially with Schlumberger. His research focus is on non-Newtonian fluid mechanics, modelling of industrial processes and particularly flows related to cementing of oil and gas wells. He has published over 100 peer reviewed articles. He is an editorial board member for: J. non-Newtonian Fluid Mechanics, J. Engineering Mathematics, Meccanica and Advances in Mechanical Engineering.

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2003 Digital Media Center • Telephone: +1 225/578-5890 • Fax: +1 225/578-8957