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# NON-NEWTONIAN FLUID MECHANICS

## Brief survey of research activities at CEFT

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### Abstract

The investigation on non-Newtonian Fluid Mechanics at CEFT can be subdivided in three main topics: non-Newtonian fluid mechanics in turbulent flow, computational rheology and other applications. The presentation briefly describes, and shows some of the results, of the various activities of the group under these three headings, which are summarized below:

#### I- Non-Newtonian Fluid Mechanics in Turbulent Flow

- 1) Rheology of dilute polymer solutions (CMC, Tylose, Xanthan gum, Laponite);
- 2) Experimental investigation of wall-dominated turbulent flows: pipe flow;
- 3) Experimental investigation of wall-free turbulent flows: sudden expansion;
- 4) Development of a turbulence model: Reynolds- stress based turbulence model coupled with a GNF with provision for elongational effects.

#### II- Computational Rheology: Development of efficient finite-volume methods with colocated grids

- 1) Implementation of complex constitutive equations: FENE-P, Giesekus, and so on;
- 2) Implementation of high-order and high resolution schemes for discretization of convective terms.

#### III- Other applications

- 1) Flow around cylinders: Experimental work of relevance to heat exchangers
- 2) Experimental characterisation of the flow in mechanically agitated vessels with various impellers, single and two-phase fluids, Newtonian and non-Newtonian fluids;
- 3) Local loss coefficients in pipe fittings and accessories with polymer solutions and Laponite suspensions: experimental characterisation in the laminar and turbulent regime and numerical predictions in laminar flow;
- 4) Investigation of annular flows of relevance to drilling of oil-wells: numerical work carried out in cooperation with experimental work at the University of Liverpool;
- 5) Slug flows with polymer solutions and Laponite suspensions.