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Vakgroep: **Technische Stromingsleer**

In het kader van zijn doctoraalopdracht zal

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een voordracht houden getiteld:

Modeling of Non-Newtonian Flow in Pipe-in-Pipe System

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Summary:
Crude oil is a primary and essential source of energy in the world. Due to declining resources in conventional oil the proportion of waxy-crude-oils is increasing. When a pipeline is shutdown for maintenance or emergency reasons waxy-crude-oils can form a gel-like structure in the pipeline. The gel-like structure results in a yield-stress which gives problems at the restart of the pipeline. A possible solution could be provided by a flexible pipeline inside a steel pipeline, with the waxy fluid (Bingham fluid) flowing through the inner pipeline and a Newtonian driving fluid flowing through the annulus. Other areas where similar flow systems exist are the food-processing industry and the human body.
The goal in the present research is to derive the governing equations, analyze the wave propagation properties of the system and set-up a numerical method for a pipe-in-pipe system. The flow is modeled using the quasi-one-dimensional Euler equations, coupled with a tube-law to model the flexible pipeline. The viscous behavior of both the Newtonian- and the Bingham-fluid is modeled using a friction factor.
The Jameson-Schmidt-Turkel (JST) scheme is used to discretise the Euler equations.
For various limiting cases, e.g. a very stiff inner pipeline or a large area ratio of inner to outer pipe cross-section, the analytical solution of the eigenvalues is found. This is used to verify the results from the numerical method. Also, for a system with two identical fluids, the analytical solution of the linearized problem is found. Furthermore instability due to a relatively flexible inner tube is investigated.
Although interesting results are obtained from the numerical method, it is yet unclear if a flexible pipe-in-pipe system can help in the restart of a pipeline.
Finally a possible alternative approach is discussed to derive the system of equations through a variational principle based on exchange of energy density between the flexible pipe and the fluids.

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