COLLOQUIUM ANNOUNCEMENT
Faculty of
Engineering Technology

Subdepartment **Engineering Fluid Dynamics - CTW**
Department **Mechanical Engineering**

As part of his / her masterassignment

Bas Pollemans

will hold a speech entitled:

Experiments on the rheological behaviour of neutrally-buoyant particle-liquid suspensions

Date: 30-06-2015
Time: 14:00 hr
Room: N109

Summary:

The flow behaviour of concentrated suspensions (consisting of liquid and solid particles), in applications as in dredging of sediment on sea beds, is not yet fully understood. A detailed description of the flow behaviour, such as the suspension viscosity of liquid-particle flows, is an important input parameters for modelling purposes. Here experimental data is gathered to this end.

The suspension viscosity, or effective viscosity, is the most important parameter in this study. The effective viscosity is dependent on the suspension volume fraction of particles, the shear rate, the dynamic viscosity of the suspending liquid and the particle diameter of neutrally-buoyant and spherical particles. Experiments have been performed using a Couette rheometer, which measured the suspension shear stress, suspension shear rate and thus the effective viscosity. The previously listed parameters are varied, one at a time, in order to investigate their influence on the effective viscosity. The relative viscosity, which equals the ratio between the effective viscosity and the dynamic liquid viscosity, is commonly used to describe the factor by which the effective viscosity is increased through the presence of solid particles.

The experimental results show that the dependence of the shear stress on the shear rate is described by a power law function $\tau=K\dot{\gamma}^N$, involving the consistency index K and the flow index N. The latter parameter describes the degree of shear-thinning (N1). The material behaviour can therefore be condensed into K and N indices. Trends observed in these experiments for K and N are analysed and discussed.

It is observed that the K index increases with higher volume fractions. This behaviour is also found in literature. The N index is smaller for higher volume fractions, which indicates a larger degree of shear-thinning behaviour. When the dynamic viscosity of the suspending liquid is increased (accomplished by varying the temperature of the suspension), the K index increases but less than linearly as one would expect. When the particle diameter is varied, it is found that larger diameter particles result in a decrease of the K index, when compared to smaller diameter particle suspensions. When the particle diameter is larger, the behaviour more closely resembles Newtonian flow with N=1. This statement is however not generally applicable, as for high viscosity fluids it is known that the relative viscosity is only dependent of the volume fraction. The current experimental results form a solid basis for a mathematical model describing suspension behaviour.

Assessment committee:

Prof.dr.ir. C.H. Venner	(chairman)
Dr.ir. N.P. Kruyt	(mentor)
Ir. B.J. Konijn	(mentor)
Dr. G.G.M. Stoffels	(external member)

chairman,

(Signature)

d.d.