Capability Statement
Final Settlement Modelling with ClariSim

Introduction

MMI Engineering have specialist knowledge in the application of Computational Fluid Dynamics (CFD) for external and internal flows. This area of expertise has enabled the in-house development of MMI-ClariSim - an application built specifically for modelling Final Settlement Tanks (FSTs).

The MMI-ClariSim interface is both a mass flux calculator for estimating the performance of an FST based on 1D settling theory and a front end to the general purpose Computational Fluid Dynamics (CFD) ANSYS-CFX. In this application, the CFX code has been extensively customized by MMI, for the detailed modelling of waste water clarifiers.

The tool enables sensitivity studies to be performed for geometry modification and process condition changes, so that the maximum treatment capacity of the clarifier can be quickly and easily determined.

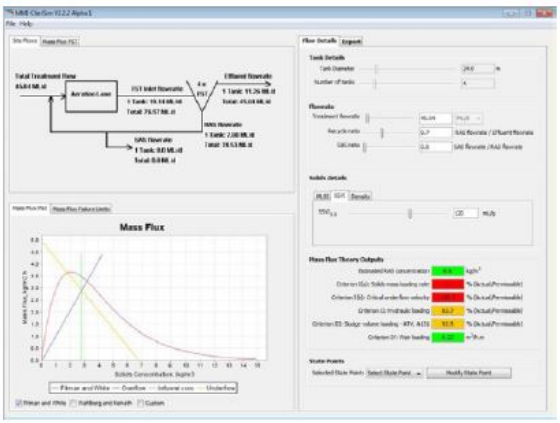

Figure 1: MMI-ClariSim Interface

The mass flux calculator is used before the CFD analysis in order to check the process condition (state point) to be considered. If the FST fails the mass flux check, then it will certainly fail the CFD analysis - regardless of the internal geometry. Hence, the precalculation with MMI-ClariSim stops wasted CFD analysis time for bounded problems that simply will not work.

The flow in a final settlement tank is non-Newtonian and therefore requires the use of a rheology model. The particle settling velocity is a function of the solids concentration and therefore requires a suitable settling velocity model for activated sludge. The application of such models in CFD analysis of final settlement tanks has been developed by MMI Engineering and validated by Burt and Ganeshalingham (2005).

MMI-ClariSim has been designed to setup each CFD model automatically (including boundary conditions, solver setup and solution strategy) for a range of inlet and sludge removal systems, including inverted bell mouth, eddy dissipating influents, slotted inlets, floor scraper and vacuum lift systems (such as Towbro). This means that for a variety of influent and sludge removal designs, minimal user input is required in order to obtain a CFD solution.

Numerical and graphical results are automatically written into html format. A 'sortable' table is used to summarise the process conditions, mass flux theory criteria and CFD results, which includes the Effluent Suspended Solids (ESS) concentration and the bed depth (i.e. the depth from the free surface to the top of the settled bed). More information, including sample results, are available at www.clarisim.net.

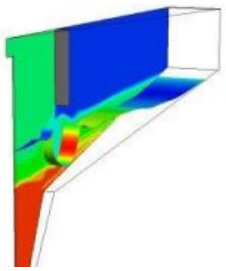
Figure 2: Contours of solids concentration in an FST.

Value Added

CFD enables designs to be assessed for adequacy prior to construction at an economical cost. Retrofit performance can also be investigated.

Publications

Burt, D., Ganeshalingam, J., “Design and Optimisation of Final Clarifier Performance With CFD Modelling”, Presented at the CIWEM / Aqua Enviro joint conference on Design and Operation of Activated Sludge Plants, 19th April 2005.

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