



Water And Environment Modeling Using CFD

by Mr. Lai Hong Yi

Mr. Lai Hong Yi is currently a committee member in Information And Communications Technology Special Interest Group (ICTSIG).

A seminar titled on “ Water And Environment Modeling Using CFD ” was held in Auditorium Tan Sri Prof. Chin Fung Kee at Wisma IEM’s 3rd floor on Thursday 13th June from 5:30 p.m. to 7:30 p.m

The aim of this IEM technical talk was to give the attendees some insights on how one can utilise numerical and computational methods to model and simulate complex fluid flows that can be found in civil, water, environmental, coastal and maritime engineering as well as other related applications. It was the first collaborative seminar between ICTSIG and Water Resources Technical Division in IEM’s history because it involved the application of an Industry 4.0 tool, which is a CFD software called Flow-3D onto water resources. It was co-organised by 2 representatives from ICTSIG: Mr. Lai Hong Yi (co-opt member) and Ir. Foo Jong Wee (committee member).

The welcoming speech was done by the seminar’s session chairman, Ir. Tan Seng Khoon, one of the past chairmen of ICTSIG. After this opening, the microphone was then handed over to the main speaker, Mr. Mohd. Haziq bin Ghazali. He delivered a focused, yet wide-ranging exposure and introduction of Computational Fluid Dynamics (CFD) that gave participants a thorough understanding of how CFD is used in key water and environment industries. His introduction to this technique to model and simulate flows in water resources includes describing what is CFD, its strengths and weaknesses, the basic workflow of CFD and the benefits of using CFD for engineering projects/works.

- 1) The design effectiveness and performance for an infrastructure project can be analysed before it gets approved and commenced so that any flaws as well as subsequent correction and component replacement costs can be minimised or avoided.
- 2) Any existing infrastructure can be fixed virtually with the help of modelling and simulation via a CFD software like Flow-3D before an actual improvement work can be done on the infrastructure's under-performing structure(s) and component(s). Hence, forensic engineering becomes enhanced due to this additional computer-based tool.
- 3) The execution of any mitigation plan or recommendations for infrastructure improvement can be studied, analysed and validated in detail using the above computer-based method. (Example analyses include the possibility of inundation/flooding due to frequent accumulation of sediments and low frequency of scheduled maintenance).

As CFD involves the creation of mesh grids which can be tedious (especially when using the finite element method (FEM) on the geometry that is being imported into a CFD software), he touched upon the methodology of free surface simulation on complex geometries, the problem that occurs in many cases that are highly transient such as sudden flash floods. He briefly talked about the Volume of Fluid

(VOF) method used to track the free surface, which is the interface between a fluid and air (example: water surface) as this method makes modelling and simulating complex and transient water flows much more easily.

Moving onto the applications of CFD, Mr. Mohd. Haziq then described the hydraulic numerical models required for simulations of typical dam and weir cases, municipal conveyance and wastewater problems, river and environmental issues, as well as coastal and maritime applications. He presented some examples involving hydraulics which are present on flows over spillways, in rivers, around bridge pilings, flood overflows, flows in sluices, locks, and a host of other structures.

After talking about the above applications of CFD, the session was handed over to Ir. C. Kamalesen, who is the current deputy chairman of the Water Resources Technical Division (WRTD). As a speaker of this seminar, his talk lasted between 15 to 30 minutes as he focused on the regulatory aspects of water-based infrastructure.

After a brief lecture by Ir. C. Kamalesen, the session was handed back to Mr. Mohd. Haziq for the final section of this technical talk. He shared the case studies and success stories in using CFD as a tool to verify new structural designs, identify and rectify problems present in underperforming existing structures, as well as making predictions and mitigation plans of probable natural disasters on a given water infrastructure. All the case studies and success stories were done by companies outside Malaysia such as Aquatis:

After ending this part of the technical talk, he concluded it by giving a recap of the important points mentioned, especially the benefits of using CFD as a great tool to model and simulate flows present in water-based infrastructure.



souvenirs and certificates of appreciation to the two speakers



photo taking session