**DATA SHEET**

**NAME OF THE DEPARTMENT**

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|---|---|---|---|
| **1.** | **Name** | **:** | **SITHIK ALIYAR** |
| **2.** | **Registration No.** | **:** | **OE17DO27** |
| **3.** | **Registered for** | **:** | **Joint Doctoral PhD** |
| **4.** | **Specialization** | **:** | **OCEAN ENGINEERING** |
| **5.** | **Category** | **:** | **HTRA** |
| **6.** | **Guide(s)** | **:** | **Dr.V.Sriram(IITM) & Prof. Pierre Ferrant (ECN)** |
| **7.** | **Date of Joining** | **:** | **02-01-2018** |
| **8.** | **Date of Registration** | **:** | |
| **9.** | **Date of DC Meetings** | **:** | |
| **10.** | **Area of Research** | **:** | **Hybrid Numerical model for Wave structure Interaction** |
| **11** | **Date of Comprehensive Examination** | **:** | **25-03-2019** |

**Details of Course Work :**

| SNo | Course no | Course Title | Sem/Year | Credit | Grade |
|---|---|---|---|---|---|
| **Compulsory Courses / Optional Courses** | | | | | |
| 1 | ID6020 | Introduction of Research (Institute Module) | 01/01 | 2 | I |
| **Elective Courses** | | | | | |
| 2 | OE5320 | Nonlinear Problems in Ocean Engineering | 01/01 | 3 | S |
| 3 | OE5450 | Numerical Techniques in Ocean Hydrodynamics | 01/01 | 4 | A |
| **Core Courses** | | | | | |
| 4 | OE5800 | Coastal Engineering | 01/01 | 3 | A |
| 5 | OE6020 | Meshfree methods applied to hydrodynamics | 01/01 | 4 | A |

**Signature of the Guide** **Signature of the Scholar**

**Title of Research Work**: Development of Hybrid numerical model for wave structure interaction and its comparison/verification with the experimental results

**Research Proposal/Abstract** :

For offshore structures , accurate prediction of wave induced loads are essential for analyzing seakeeping property, resistance in waves and its structural integrity. The wave -structure interaction problem can be assessed by various approaches. Empirical formulations, model tests in wave tanks and numerical simulation methods are all frequently used. The numerical simulation approach for the wave-structure interaction problem refers to the use of computer software and numerical analysis methods to solve and analyze the fluid flow and its interaction with the structure. The numerical simulation methods have been developed since they are able to assess complex problems where no empirical formulations exist, and their cost is often much less than a wave tank test.

Commercial software packages such as WAMIT, ANSYS,STAR-CCM+, Open foam etc. are available for wave structure interaction type of problems. The methods for the fluid simulation behind these software packages can be distinguished into two general groups by whether the viscosity of the fluid is considered or not. Potential theory is widely used if the fluid is assumed to be inviscid. Otherwise, the viscous flow is modelled by Navier-Stokes (NS) equations and solved with Computational Fluid Dynamics (CFD) approaches .

The potential flow solvers(Boundary Element Method(BEM), Finite Element Method(FEM), Finite Difference Method(FDM), Mesh-free methods etc) are efficient and accurate when the geometry of the structure is smooth and the viscous effects are negligible. However, the irrotational flow assumption of potential theory can lead to numerical difficulties in realistic wave-structure interaction scenario when the flow separation happens.

For this reason, numerous viscous flow solvers with the Computational Fluid Dynamics (CFD) approach are developed to assess the wave-structure interaction problem by solving NS equations.Numerous validations have proved that viscous CFD solvers are able to provide high fidelity results for a wide variety of applications . Practical marine and ocean engineering applications need sufficiently long simulation time resulting in a prohibitive computational cost (very high than potential solvers).

The objective of this research is to develop an accurate and efficient numerical method to simulate the wave structure interaction problem by coupling the viscous and potential flow models and the ability to treat complex flow of the viscous CFD solvers with complex marine structures. Experiment is carried out considering the complex phenomena in the offshore environments as upending the jacket(usually there will be no or less waves) in presence of waves. This experiment results will be compared (future work) and verified in the numerical model developed

**Works carried so far:**

- Experiments has been carried out and completed and submitted for Journal (Experiment details in next section- as Journal)

- Theory and application of Hybrid coupling so far: explained after Experiment section