Indian Institute of Technology
Course Details Report

Course No: OE6020

Course Name: Meshfree methods applied to hydrodynamics

Course Type:

Theory

Description:

To introduce the students to Meshfree or particle Methods and to show them that there are alternatives to the Mesh based Methods, which are currently being used by the numerical modeling group worldwide.

Course Content:

Numerical modelling; Basics of fluid mechanics; NS – Eulerian and Lagrangian Formulations; Free surface and Body boundary conditions; Time split algorithms; Strong and Weak forms; Weighted Residual methods. Overview of mesh based methods and meshfree methods; Basic techniques; Categories of meshfree methods; shape function constructions – Issues; SPH; Point Interpolations; Moving least square method; Shepard Functions; Error estimations; Support domain and Influence domain; Weight functions; Meshfree Integrations; Computational Cost; Conservation and Convergence. Meshfree methods based on Global weak form – EFG; Meshfree methods based on Local weak form – MLPG; Smoothed Particle Hydrodynamics; Moving Particle Semi-Implicit method; Essential Boundary conditions – Issues; Turbulence – Sub-particle scale; Meshfree methods applied to fluid dynamics problem; Matrix formulations and solution methods in meshfree methods; application to floating bodies, coastal engineering.

Text Books:

[1] G.R. Liu (2006), “Mesh free methods: Moving beyond the finite element method”, CRC Press, Taylor and Francis, US.

Reference Books:

[1] J. Anderson (1995), “Computational Fluid Dynamics: The basics with applications”, McGraw-Hill, USA.
[2] Li H and Mulay SS (2013), “Meshless methods and their numerical properties”, CRC Press, Taylor and Francis, US. [3] S.N. Atluri (2004), “The Meshless method (MLPG) for domain and BIE discretizations”, Tech Science Press.
[4] G.R. Liu and M.B. Liu (2003), “Smoothed Particle Hydrodynamics”, World Scientific, Singapore. (also available as E-book)