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Plenary Session

# Meshless Methods in Computational Mechanics

**Afzal Suleman**
**University of Victoria**
**Department of Mechanical Engineering**
**Victoria, BC, CANADA**

**Abstract**

Recently, meshless methods have become attractive to model problems in computational mechanics. In this plenary talk, two methods will be discussed and illustrative examples will be presented.

***Smoothed particle hydrodynamics*** (SPH) is an adaptive, meshfree, Lagrangian numerical approximation technique used for modelling of physical problems. Benchmark simulations using previously reported boundary treatments can suffer from particle penetration and may produce results that numerically blow up near solid boundaries. As well, current SPH boundary approaches do not properly treat curved boundaries in complicated flow domains. These drawbacks have been remedied in a new boundary treatment method called the multiple boundary tangent approach. In this talk, a comparative study for the weakly compressible and incompressible SPH method are discussed by providing numerical solutions for fluid flows over an airfoil and a square obstacle. It is shown that SPH can handle complex geometries using the multiple boundary tangents method, and eliminate particle clustering-induced instabilities.

***Peridynamics*** is a meshless approach that addresses some of the difficulties and limitations associated with mesh-based topology optimization methods. The most significant advantage of peridynamics is its ability to model discontinuities in a relatively straightforward manner. The minimization of compliance or strain energy was chosen as the objective function under the volume constraint. The filtering scheme was adopted to avoid the checkerboard issues and provide a high stability during optimization. Various problems were solved with and without cracks under different loading and constraint boundary conditions. Topology optimization for an unstructured discretization problem has also been investigated applied to a complex geometry.

## Short Bio

**Afzal Suleman** is a Professor and Canada Research Chair in Computational and Experimental Mechanics at the University of Victoria, Canada. He has been the founding Director of the Center for Aerospace Research. He is also a Principal Investigator at the Laboratório Associado em Energia, Transportes e Aeronautica (LAETA-IDMEC), Lisbon, Portugal. He obtained his BSc (Honours, 1984) and MSc (1986) in Aeronautical Engineering from Imperial College, U. London, UK. He obtained his PhD (1992) in Space Dynamics from the University of British Columbia, Canada. He received a National Research Council Fellowship for tenure at the US Air Force Research Labs (1992-1994). He

holds memberships of professional societies and advisory boards: National Delegate, United Nations Committee on Peaceful Uses of Outer Space (UN-COPUOS), National Delegate, NATO Applied Vehicle Technology Panel, Fellow of the Canadian Academy of Engineers, Academician of the Academy of Sciences of Lisbon, Fellow Royal Aeronautical Society, and Associate Fellow of the American Institute of Aeronautics and Astronautics. He is currently a member of the Government of Canada Defense and the Space Advisory Boards. Research interests in Aeronautics and Space.