Mechanical Engineering
Fall 2007 Seminar

Wednesday, October 10, 2007

4:00 PM – 5:00 PM

ROOM: 224 MEC

"Investigation of Formation and Applications of High-Speed Liquid Projectiles"

Dr. Oleg Petrenko
New Jersey Institute of Technology
Newark, NJ

ABSTRACT

The presented work comprises experimental and numerical studies of generation and application of high-speed liquid projectiles. Numerical models were created for a projectile formation by two kinds of launchers, water extruder and water cannon. Inviscid, quasi-stationary model of water flow in the extruder was applied for investigation of the projectile generation in the water extruder. Unsteady 1-D compressible and incompressible models of water flow in the water cannon were applied for the process investigation. It is demonstrated that fluid compressibility and subsequently wave processes in the fluid do not contribute for the fluid acceleration. Thus, the acceleration is due to redistribution of the fluid momentum between different parts of a projectile. The numerical study also demonstrated the feasibility to attain the supersonic velocity in the course of acceleration in a converging nozzle. The constructed numerical model was integrated into a simplex search optimization procedure and used for evaluation of an optimal parameter of a launcher. Particularly, the possibility of the improvement of the nozzle design was shown.

An experimental technique was developed and applied for measurement of the projectile head velocity. The acquired experimental data validated the developed numerical technique. Water velocity of 1750m/s was attained in a converging nozzle. A series of experiments were carried out in order to investigate feasibility of material processing and neutralization of explosive material by the use of high-speed liquid projectile. The feasibility of the development of novel impact-based construction, manufacturing and demining technology based on the use of high-speed liquid projectiles was demonstrated.

Biography

Dr. Oleg Petrenko is a Postdoctoral Research Associate at the New Jersey Institute of Technology. He received his BS and Masters at the Moscow Institute of Physics and Technology and the Doctorate Degree at the New Jersey Institute of Technology. His areas of interest include applied hydrodynamics, high speed impact. He has authored more then 20 technical publications.