# Contributed Session 1: Hamiltonian Systems

**Trajectory of a periodically delta-kicked system moving at low speed: Comparison of the predictions of Newtonian and special relativistic mechanics**

**Boon Leong Lan**
Monash University, Malaysia
lan.boon.leong@eng.monash.edu.my

The dynamics of a periodically delta-kicked Hamiltonian system moving at low speed (i.e., much less than the speed of light) is studied numerically. In particular, the trajectory of the system predicted by Newtonian mechanics is compared with the trajectory predicted by special relativistic mechanics for the same parameters and initial conditions. We find that the Newtonian trajectory, although close to the relativistic trajectory initially, eventually disagrees completely with the relativistic trajectory, regardless of the nature (chaotic, non-chaotic) of each trajectory. However, the agreement breaks down very fast if either the Newtonian or relativistic trajectory is chaotic, but very much slower if both the Newtonian and relativistic trajectories are non-chaotic.

$\longrightarrow \infty \diamond \infty \longleftarrow$

**Numerical Solution of Integral Equation of the First Kind by Using Wavelet Galerkin Method**

**Khosrow Maleknejad**
school of mathematics Iran university of Science & Technology, Iran
maleknejad@iust.ac.ir
**N. Aghazadeh**

It is well known that the Fredholm integral equation of the first kind is one of the important ill-posed problems which has many applications in engineering fields. In this paper, we use galerkin method which is based in wavelet. For overcoming ill-posedness of problem we use Preconditioned Conjugate Gradient (PCG) method. Also for showing efficiency of the method we use algorithm in few examples.

KeyWords: Fredholm integral equation, Integral equation of the first kind, Wavelet basis, Galerkin method, PCG method.

$\longrightarrow \infty \diamond \infty \longleftarrow$

**Navier-Stokes dynamics on a differential one-form**

**Troy L. Story**
Morehouse College, USA
tstory@morehouse.edu

After transforming the Navier-Stokes dynamic equation into a characteristic differential one-form on an odd-dimensional differentiable manifold, exterior calculus is used to construct a pair of differential equations and a tangent vector (vortex vector) characteristic of Hamiltonian geometry. A solution to the Navier-Stokes dynamic equation is then obtained by solving this pair of equations for the position and the conjugate to the position as functions of time. The conjugate to the position is shown to be divergence-free by contracting the differential 3-form corresponding to the divergence of this conjugate with a triple of tangent vectors, implying constraints on two of the tangent vectors for the system. Analysis of the solution reveals that the conjugate to the position is bounded since it remains finite as the position goes to infinity, and is physically reasonable since the square of the gradient of the principal function is bounded. By contracting the characteristic differential one-form with the vortex vector, the Lagrangian is obtained.

$\longrightarrow \infty \diamond \infty \longleftarrow$

**The equations of physical processes in dissipative media as variation of functionals of energy**

**Basil Tchaban**
University of Rzeszow, Poland
vtchaban@univ.rzeszow.pl
**Ewa Kycia and Andrew Tchaban**

In the paper is shown that the well-known partial differential equations of electromagnetic, mechanical and heat processes in dissipative media may be received by general variation Hamilton's principle having issued from full energies (kinetic, potential, dissipation and sources) which are located in space of integration zone. On this base are received the ordinary and partial differential equations of mechanical motion, fly-wheels, driving shafts, electric circuits, heterogeneous lines, electromagnetic field vector potential and not stationary heat conductivity. For examples are shown as receive the partial differential equations of unsteady heat conductivity, driving shaft and heterogeneous line which belong to different physical systems. The Hamilton's actions are interpreted as corresponding functional.

$\longrightarrow \infty \diamond \infty \longleftarrow$