From the Guest Editors

A great many of the mathematical problems in heat and fluid flow are still open owing to the complexity of engineering practice. With the help of the differential operators, *e. g.*, classical, fractional-order, local fractional, and other operators, our chief aims of the special issue is to present more reasonable models for practical engineering problems in the area of heat and fluid flow, to develop some methods to find the approximate or exact, analytical or numerical solutions for the problems.

The special issue titled Modern Mathematical Problems in Heat and Fluid Flow consists of 45 papers. It is divided into 3 main parts.

The *first part* of the special issue consists of 27 papers based on very high level results involving the heat flow in different operators.

In classical heat flow, the ODE and PDE for heat-transfer problems were studied. For example, new integral transforms similar to the Laplace and Sumudu transforms were proposed for solving the steady heat flow problem for the first time. The distributions of film cooling effectiveness and convective heat transfer coefficient on cutback and land surface was analyzed. The Schwarz waveform relaxation algorithm with Robin transmission conditions for a class of representative heat equations with distributed delay was discussed. The numerical solution for the 3-D and unsteady turbulence model in heat transfer was investigated. The metamaterial thermal concentrator model to control heat flux was discussed.

In order to describe the fractional heat flow, the fractional-order heat (diffusion or heat-like) equations were investigated. For example, the approximate solution for fractional diffusion equations in sense of Caputo fractional derivative was investigated by using the Adomian decomposition and series expansion methods. The variable separation method was considered to solve the variable-coefficient time fractional heat-like and wave-like equations. The combination of reproducing kernel theory and spline for handling the variable-order anomalous subdiffusion equation was considered. The reproducing kernel method was used to handle the fractional heat equation with non-local boundary conditions. The solution for the steady heat flow problem within fractional derivative without singular kernel was presented.

In order describe the fractal heat flow, the local fractional ODE and PDE (heat-diffusion, heat-transfer, Laplace, and Poisson equations) were investigated. The local fractional Volterra and Volterra integro-differential equations were also proposed with the help of the theory of local fractional integral equation. The local fractional Euler's and integrating factor methods were used to investigate the solutions for steady fractal heat flow problems. The local fractional differential transform method was utilized to handle the steady fractal heat transfer at low excess temperature. The local fractional Laplace transform series expansion and characteristic equation methods were employed to solve the local fractional heat-transfer equation. The local fractional variational iteration algorithm III, Laplace transform variational iteration algorithm III, and characteristic equation method were used to solve fractal heat-diffusion equations within local fractional derivative. The characteristic equation method and Sumudu transform series expansion method for solving the local fractional Laplace equation were investigated. The local fractional functional decomposition method for solving local fractional Poisson equation was discussed. The fractal complex transform technology was used to solve the fractal relaxation and diffusion equations within a new local fractional derivative.

The *second part* of the special issue consists of 12 papers based on very high level results involving the fluid flow in different operators.

In classical fluid dynamics, some PDE were discussed. For example, the numerical solution for the reaction-diffusion problem arising in fluid dynamics was handled. The parallel computation problem for the dynamic PDE for turbine blades under centrifugal load and flow load was discussed. The transient temperature field and thermal stress field for start-up process of a turbine unit by combing thermal-structure coupling technique and pattern search optimization algorithm were discussed. The3-D unsteady numerical investigation for air turbine with static temperature of outlet was presented.

With the help of the fractional derivative without singular kernel, the fractional Maxwell fluid and Navier-Stokes equations were proposed.

In fractal fluid flow, the Navier-Stokes and Korteweg-de Vries (KdV) equations within local fractional derivative were discussed. For example, the 3-D compressible and incompressible Navier-Stokes equations in different co-ordinate system were proposed. The method of separation of variables, series expansion method and Laplace series expansion methods for handling the local fractional KdV equations were presented. The fractal complex transform technology via local fractional derivative was used to consider the non-linear KdV equation.

The *third part* of the special issue consists of 6 papers based on very high level results on the topics related to the fractal theory, and heat and fluid flow.

For example, a local non-linear optimization of the turbine blade by using fractal theory was suggested. The non-linear vibration response characteristics of a long steam turbine last stage blade with snubber and shroud with the help of fractal theory were proposed. The non-catalytic gasification of corn cob in supercritical water and studied the effects of residence time and temperature with the Fourier transform infrared spectroscopy to obtain the reaction bottleneck for complete gasification was investigated. The conservative implicit difference method for the generalized Rosenau-KdV equation and its numerical solution was reported. A non-linear thermo-chemo-poroelastic model with the effect of chemical, thermal, and hydraulic gradients was investigated. Finally, the soliton solutions for the (3+1)-D generalized Kadomtsev-Petviashvili equation were considered.

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