Department of Computational and Data Sciences
Indian Institute of Science
Bangalore - 560012

Advertisement No: CDS/DS/MHRD-STARS/Jan-2020/PA

Date: 21/01/2020

Advertisement for Project Assistant Positions

Indian Institute of Science (IISc) now seeks to recruit Project Assistants (PA).

Specific Roles & Responsibilities: The primary task will include the following.

- Derivation of numerical schemes to solve stochastic partial differential equations using finite element method.
- Implementation of the above schemes in C++ with OpenMP/MPI/CUDA for deployment in distributed computing platforms.
- Applying the above software to solve fluids, energy, and/or structures related problems.
- Presenting results and writing journal papers.

Essential Qualifications:

- Undergraduate (B.Tech, BE, B.Sc) or Masters level (M.E., M.Tech, M.Sc or equivalent) degree in Mechanical, Aerospace, Chemical, Civil, Electrical, Mathematics and Computing, Computational and Data Sciences or equivalent subjects.
- Familiarity with C++.
- Experience in OpenMP/MPI/CUDA-based parallel applications is desired.
- Experience in Finite Element Methods is desired.

In all cases, strong background in Linux, operating system concepts and programming are required. The candidate is expected to have good communication skills (speaking and writing) and should be willing to work in a team environment.

The candidate should have secured at least a first-class degree.

Salary: Rs. 20,000 – Rs. 31,000 p.m. (Depending on experience; as per IISc Norms)

Terms of Appointment: This is a contract appointment, initially for one year and renewable thereafter based on an annual evaluation of performance.

Conversion to Ph.D.: Outstanding candidates will be considered for admission to our regular Ph.D. program and stand a good chance in gaining an accelerated Ph.D. (subject to all IISc norms and regulations)

How to Apply: Interested candidates may send their resume (preferably in pdf format, with subject marked Advertisement No. CDS/DS/MHRD-STARS/Jan-2020/PA) by email to: deepakns@iisc.ac.in .

Candidates should also complete the programming task and send the link to the git repository of the solution. In the resume, provide evidence to meeting the essential qualifications listed above.

Programming Task: Complete the Heat Diffusion and/or Monte Carlo Simulation programming task in the next page.

Last date for application: February 15, 2020.

Contact Details:

Dr. Deepak N. Subramani, Department of Computational and Data Sciences, Indian Institute of Science, Bangalore – 560012.

Prof. Sashikumaar Ganesan, Department of Computational and Data Sciences, Indian Institute of Science, Bangalore – 560012.

Programming Tasks

Heat Diffusion

Solve the unsteady heat diffusion equation on a square domain [0,1] x [0,1] with an initial temperature distribution T(t=0, x, y) = {40 C, if (x-0.5)^2+(y-0.5)^2 < 0.2; 20 C otherwise}. The boundaries are maintained at 20 C all the time.

First choose a discretization scheme (FD or FV or FE) and write the discrete heat equation. In case of FD, identify the order of the scheme, FV identify the control volume and for if using FE, write the weak form.

Thereafter code the above in C++, compile and plot the transient response at time t=5s, 20s, 50s and 7200s.

Please include the code, input files, output images in your git repository. Prepare a report (of max 1.5 pages, 11pt font, 1-inch margin, in latex) with the results.

Monte Carlo Simulation

Consider the set of coupled ODEs:

$$\frac{dx}{dt} = 10(y - x)$$
$$\frac{dy}{dt} = x(28 - z) - y$$
$$\frac{dz}{dt} = xy - \frac{8}{3}z$$
$$x(0) = y(0) = z(0) = 1$$

Write an explicit RK-4 scheme to solve the above coupled system.

Now consider that the initial condition is not exactly known – it is only known that the initial value of (x,y,z) is a joint Gaussian with mean (1,1,1) and covariance of identity matrix. Sample 10,000 elements from this joint PDF and simulate the above coupled ODEs with each of those initial conditions. Plot the pairwise joint PDF of (x,y,z) at a few timesteps and explain your findings.

Please include the code, input files, output images in your git repository. Prepare a report (of max 1.5 pages, 11pt font, 1-inch margin, in latex) with the results.

You may use MATLAB, Python, or C++ to solve the above problem.