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To Whom It May Concern,

This is a cover letter for a *Postdoc* position in the High Performance Computing Tools group. My name is Dr. Rahulkumar Gayatri and I am currently based in Bangalore, India. I work as a technical specialist in the High Performance Computing group (HPC) at Wipro Infotech. I have been in this position since September 2015. I provide technical assistance to clients who wish to parallelize their application/algorithm. For this, I learn the theory and the science involved in the client's algorithm and apply my knowledge of parallel programming to develop parallel versions of the same.

Currently I am working on a project called Moose. It involves simulation of neural interactions in a human brain and falls in the category of computational science. The project is designed and implemented at the National Center for Biological Sciences, India (NCBS). The software uses a set of linear solvers to calculate the chemical and electrical interactions between the neurons in a cell. It is a multi-scale project and allows both distributed and shared memory parallelization to be introduced to speedup the simulation. Within each cell shared memory parallelism (using OpenMP and Pthreads) is implemented, so that, each thread updates a part of the cell structure in finite time steps. The shared memory parallelization gave a performance boost of 5X speedup on 8 threads. Currently I am working on the MPI-based implementation, wherein different types of cells, (representing different parts of the brain) are distributed over the available nodes for simultaneous execution. The work done on the shared memory parallelism will be a part of the next release of MOOSE.

Previous to this, I was a Doctoral student at Barcelona Supercomputing Center (BSC), Barcelona, Spain. I graduated in March, 2015. My advisors were Rosa M.Badia and Eduard Ayguade. During this period, I was a part of the Programming Models group at the Barcelona Supercomputing Center (BSC). My Doctoral thesis was focused on speculative synchronization techniques for the StarSs framework, a task-based programming model. I extended the StarSs framework to speculatively update shared memory locations using STM, instead of the traditional lock and mutex based mechanisms. The results achieved with this idea and implementation showed an increase in performance of applications which have high contention for locks.

An extension to speculative memory updates is the speculative execution of tasks, where tasks can be scheduled before their presence in the execution flow can be confirmed. I implemented a lightweight rollback mechanism which can be used to undo the updates of tasks in case the speculation fails. The idea of greedy task execution, wherein the tasks are scheduled even before their validity can be ascertained improved the performance by an average of 20%. At BSC, I also worked on porting applications using SMPs, StarSs implementation for SMPs onto Symmetric Multiprocessors (SMPs). I parallelized the Graph500 benchmark suite using SMPs. My background in mathematics helps me develop novel ideas for parallelization of algorithms and efficient ways to implement them. These applications are a part of the StarSs application repository.

In my Mtech thesis, I designed and implemented a Breadth First Search algorithm, that optimises the use of low memory available in the Synergistic Processing Element(SPE) of IBM's Cell.B.E processor. The strong point of the implementation was this design of the data structure to represent a node, which increased the memory locality.

The above mentioned details highlight my experience in the area of compiler and runtime development for parallel programming models. I have worked extensively with STM and on porting applications using widely used programming models such as OpenMP, Pthreads and MPI. I am also experienced in the use of various tools to analyze the results obtained and to optimize on the performance bottlenecks. Working in the programming models group at BSC and in the TERAFLUX project has taught me to effectively collaborate with other researchers to achieve the set goals. Due to my experience and my skill set, I believe that I will be able to fulfill the duties of a PostDoc researcher in the HPC tools group. This is my main motivation to apply for the current job.

The information regarding my publications is available in my resume. Please let me know if there are any other materials or information that will assist you in processing my application. Thank you for your consideration. I look forward to hearing from you.

Sincerely,

Rahulkumar Gayatri