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To Whom It May Concern,

This is the cover letter for the position of *Computational Science Postdoctoral Fellow* - 82932. My name is Dr. Rahulkumar Gayatri and I am currently based in Pleasanton, California. Till Oct 2016, I was working as a technical specialist in the High Performance Computing group (HPC) at Wipro Infotech. My job was to provide technical assistance to clients who wish to parallelize their application/algorithm. For this, I used to 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.

On my last project I worked on Moose, <http://moose.ncbs.res.in>. It simulates the neural interactions in a human brain. The project is designed and implemented at the National Center for Biological Sciences, India (NCBS). The software uses a set of linear solvers such as Kinetic and Stochastic solvers to calculate the chemical and electrical behavior inside a cell. Due to the complexity of the problem, a cell is subdivided into multiple parts and different sub-cell parts are executed simultaneously using the shared memory parallelism. I implemented the Pthread and OpenMP parallelizations to simultaneously execute the various parts of the cell. The reason to implement two versions of the shared memory parallelism was to provide the students of NCBS a choice in case one preferred a particular programming model over the other. The efforts gave a performance boost of 5X on an 8-core machine. 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 built applications such as NQueens, Specfem, Jacobi and Gauss-Seidel solvers, that show the performance benefits, ease of use and portability of using the StarSs framework. I also

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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.

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. I have worked on applications from the domains of linear algebra, machine learning and clustering algorithms and graph algorithms. I am also experienced in the use of various tools to analyze the results obtained and optimize on the bottlenecks. I have experience in working with the widely used parallel programming models such as Pthreads, OpenMP and MPI. Most of my programming and scripting is done in C/C++ and python. Due to the above mentioned reasons, I feel that my skill set is an ideal match for this particular postdoc position. I feel the advances in High Performance Computing area and parallel programming should be applied to other domains to find faster and better solutions for the day-to-day problems. 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,

Rahul Kumar Gayatri